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CHEMICAL & METALLURGICAL ENGINEERING

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Editor

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The Approaching Business Revival

BUSINESS in the United States is undoubtedly in a period of great economic confidence. A contributing factor is the general spirit of optimism that prevails throughout the country, for it is well recognized that much of the impetus behind active business has its origin in public psychology. Some have confessed, however, to a sense of uneasiness over the present revival of industry and trade, feeling that measures should be taken to check the present upward swing before a boom develops. Such proposals are doubtless based on an assumed parallel between present conditions and those prevailing in 1919 which resulted in the collapse of 1920 and 1921. It is argued that if proper steps had been taken in 1919 the difficulties that followed the sharp upturn early in that year could have been minimized and possibly avoided.

It is to be noted, however, that there are essential differences between the present situation and that of 1919. In the first place, industrial production is not running nearly up to 100 per cent capacity and, it is pointed out by competent observers, inflation does not begin until full productive capacity is reached. There may be some instances where full capacity is being approached, but the great basic industries of the country are not operating at full time. Iron and steel production is probably not above 80 per cent of capacity; coal production is probably below 70 per cent, and textile manufacture will not exceed 75 per cent. As for labor, not only is there an available reserve but many of the employed are not working full time. Hence there seems to be room for cautious and substantial expansion of business.

Another item favorable to holding an unwarranted boom in check is the memory of the last depression. There is still a large element of caution in industry despite the prevalence of cheap money and the antics of the stock exchange. It is recognized that the latter have little to do with great processes of production and distribution and that they are not necessarily a reliable index of economic tendencies. A further reason for caution is found in conditions abroad, where industry and trade are reviving and the standard of living is rising to new levels. German productivity especially is reaching a status that must mean an exportable surplus of goods and re-entry into world markets.

It must be regarded as fortunate that political as well as business conservatism is dominating world affairs and is likely to continue in the saddle as long as Russia persists in furnishing Exhibit A for radicalism. If business men on both sides of the Atlantic keep their heads cool and their feet on the ground during 1925, there is every reason to believe that the year will witness an increased volume of profitable business.

German Production Costs Under the Dawes Plan

CONSIDERABLE interest has been expressed in the probable cost of industrial production in Germany under the Dawes plan, in view of the fact that the export surplus of that production must come into competition with American and other commodities. Prior to the war German industry undoubtedly enjoyed many subsidies and state favors which lowered her production costs, but under the Dawes plan it seems inevitable that she is bound to be a higher-cost producer for some time.

In the first place, Germany has a comparatively small liquid capital and interest rates are abnormally high. We are informed that they have ranged from 18 to 40 per cent within a few months past, and that they are not likely to drop below 8 per cent to 10 per cent for a long time to come.

Transportation costs in Germany will be higher than during pre-war years, for the railroads are now bonded and must be run to make profits and not to subsidize industry in its export trade.

Labor will undoubtedly rise to higher cost levels, for a people that has once enjoyed a higher standard of living will not content itself indefinitely with a standard as low as that prevailing in Germany in post-war years. An example has recently come to our notice of an increase of about 300 per cent in the daily wage of one industry during the past year, with prospect of still further wage rises.

Finally, taxes must inevitably be high in order to sustain the government and help meet reparation payments. It is difficult to see how such a combination of economic conditions can tend toward other than a higher cost for industrial production.

Lamentations Of a Scientist

MUSCLE SHOALS is all a horrible mistake. In the first place it shouldn't be called "Muscle Shoals" anyway, for this common and now official name is in reality a vulgar corruption of "Mussel Shoals," which is so descriptive of "the immense number of species and individuals of fresh water mussels (Naiades) which used to be found at this locality." But it is no mere quibble over words that prompted the serious communication that appears in the Dec. 19 issue of *Science*

over the name of Dr. Arnold Edward Ortmann, curator of invertebrate zoölogy at Carnegie Museum and distinguished international authority on decapod and schizopod crustaceans, cephalopods and bryozoans.

Ninety years ago an observing traveler reported that this broad expansion of the Tennessee River abounded in various species of Naiades, the like of which could not be found in the whole wide world. "The cause of this unusual development of Naiad-life"—it is Dr. Ortmann explaining—"is found in the fact that here two old faunas, in themselves exceptionally rich, come together, the so-called 'Cumberlandian' belonging to the Upper Cumberland and Upper Tennessee rivers and the Ohioan fauna of the 'Interior Basin.'"

But, alas, how has this veritable treasure fared under man's domain and the Congressional pork-barrel? "The beautiful islands and the general features of the river itself are gone, as well as a large portion of the fauna, chiefly that of the mussels, which depend on the ecological conditions once presented there. For a dam has been built, the Wilson dam, . . . drowning entirely the Little as well as the Big Mussel Shoals. With the destruction of conditions favorable for Naiad-life also the Naiades have been destroyed, which is so much more to be regretted." But this is not the full extent of the distressing situation. We read further:

> There are some shells yet present in this region, chiefly below the dam; but this is only a small remnant of the original richness of the fauna, and there is great danger that also this remnant will gradually disappear, due to the pollution of the waters which will be a consequence of further "improvements" connected with the dam. And then the "glory of the mussel shoals" will be entirely gone, those characteristic and unique features which would rather have deserved to be kept intact and preserved as a "natural monument," second only to very few other monuments in the United States.

Need we add more to the lamentations of the distinguished scientist than to sum up in his own words, "Truly, a sad state of affairs!"

Has the Rubber Industry Discovered Gold Bricks?

IT IS only natural that the rubber industry should be on the alert to discover and to develop a means for putting idle machinery to work. It is good business also for the rubber producers of the world to sponsor any movement that promises to relieve them of a burdensome surplus of material. From the point of view of the industry and of growers, therefore, the stage is nicely set for the arrival of such a product as rubber paving blocks.

Experiments along this line have been conducted by several companies in the United States—likewise by a group in England known as Rubber Roadways, Ltd., which has been sponsored in its efforts by the Rubber Growers Association. Present results prove with certainty that rubber paving unusually well fitted for special purposes can be produced. A block carrying from 20 to 40 per cent of new rubber stock blended with a considerable fraction of reclaimed shoddy possesses satisfactory physical properties, including desirable surface and sound-deadening characteristics. On the other hand, no means has yet come to our attention whereby these blocks may be inexpensively and firmly fastened to the prepared foundation surface.

Granted that its technical development is an assured fact, the rubber paving block must still meet competition on a dollars-and-cents basis with the road materials that are now extensively used. The nearest comparable product, wood blocks, can be used at scarcely more than half the cost of rubber, macadam for even less. How then can the rubber industry hope to find its paving block business a source of profit?

For bridge work, for hospital and school streets and for special applications similar in nature, the advantages to be gained through the use of the new material are likely to recommend its limited adoption. But with a constantly growing tendency on the part of road commissioners to build the reatest possible number of miles of highway with appropriations in hand, any large degree of general popularity for rubber roadways in this country is not to be expected. With a ratio of costs of something like 16 to 7 in favor of macadam, for instance, rubber paving must live to a ripe old age to compete with it on anything like an even basis. In the light of all the evidence so far brought to bear on the question, there seems little justification for great optimism on the value of block production as a means for opening up a large new market for the rubber industry.

Temperature Differences in Small and Commercial Units

MODERATE rises in temperature are often overlooked in preliminary research involving the practical application of fundamental chemical reactions, with the result that modification of plant design or operation is necessary later, or the process becomes impracticable. This is particularly true if an unstable solvent is used, or if precise control of temperature is necessary, maintained sometimes by unnoticeable radiation from small apparatus used in preliminary tests. Thus in the interesting preliminary work that led to the development of the Kocher process for the hydrolysis of cellulose, the ill effect of a rise in temperature was noticed only when a comparatively large experimental unit was put in operation. In designing the commercial plant it was found necessary to provide water-jacketed vessels.

The incident suggests the often unsuspected influence of temperature on commercial operation, and the wisdom of experimentation with semi-commercial units rather than commitment to the expense of building a large plant the operation of which is anticipated on the results obtained by laboratory-scale tests. In the extraction of gold and silver by the cyanide process many examples may be quoted to illustrate the importance of recognizing the unstable nature of the solvent and the need for careful control of the precise chemical reaction desired and the avoidance of those undesired. In an attempt to achieve simplicity the practice of milling the raw ore direct in the solution, instead of in alkaline water, has been adopted in many instances without preliminary recognition of the disadvantages that are inevitable when commercial operations are under consideration. At the Mysore mine, in India, for example, milling in cyanide solution was adopted after laboratory tests in small porcelain grinders had given encouraging results. When applied on a commercial scale, however, using 18x6-ft. tube mills, the results were disastrous and a reversion to milling in water was found necessary. The heat formed in the

large units was sufficient to upset the calculated program of normal reactions.

Similarly, the successful commercial operation of a large cyanide plant in Nevada was jeopardized by the abnormal loss of cyanide, traced eventually to the ball-mill circuit. It was apparently impracticable to substitute milling in alkaline water; but, by reducing the strength of the cyanide solution at that point, the consumption of an expensive solvent was lowered from 3½ to 1 lb. per ton of ore. Temperature rise and the gradual accumulation of heat in large grinding units threatened the economic success of the venture; and, although conditions were ameliorated by a modification of flow-sheet which, luckily, was practicable, it is doubtful if the subject of temperature rise received adequate if any attention in the preliminary stages of research, experimentation and planning.

Why the C.W.S. Reserve Corps Is Entitled to Your Support

IN THE Officers Reserve Corps of the Chemical Warfare Service the chemical technologists of the country have an unusual opportunity to broaden their own interests and at the same time to be of vital importance in the scheme of national defense.

Entirely aside from patriotic motives, there are substantial reasons why it is desirable to belong to the organized reserves. In the first place, it assures the citizen a definite and satisfactory military standing in time of national emergency. In the fever of war-time administration, even the well-qualified citizen is fortunate if he finds his most useful post. A further advantage is the privilege of attending summer camps and training schools, neither of which is compulsory or entails any obligation on the part of the reservist.

Our country needs an adequate Chemical Warfare Service, and this branch of the army, to be fully prepared, must lean heavily on a strong reserve of technologists who are continually in touch with the latest thought and practice. Although the present allowable strength of the Chemical Warfare Service Officers Reserve Corps is 2,749, the actual number holding commissions is but 583. This serious deficiency in the national defence should enlist the immediate and active support of the chemists and chemical engineers.

Present Status of Government-Owned Patents

EVER since it was announced that the United States is empowered to license government-owned patents to industry there has been more than casual interest in the number and character of such patents. *Chem. & Met.* has assiduously tried to obtain from various government bureaus lists of patents owned by or assigned to the government, but without success. Apparently the decision of the Attorney-General in the matter took the government by surprise, for it found the whole business in a state of uncertainty if not demoralization. Nobody knew what patents the government owned or how or when they were acquired. Truly the left hand knew not what the right hand had done in the matter.

Under such chaotic conditions it is hopeless for industry to expect to know for some time to come what patents the government owns, to say nothing of considering whether or not licenses are desirable.

Prohibition and Industrial Alcohol

INDUSTRIAL alcohol is about to become the victim of uninformed and misguided zealots in the ranks of prohibition unless the industry and its friends can combine to defeat the Cramton bill. This measure, which has already passed the House and is now in the Committee on Judiciary of the Senate, proposes to give the Commissioner of Prohibition the same control over industrial alcohol plants as is now conferred by law upon the Commissioner of Internal Revenue. In other words, prohibition authorities will run the industrial alcohol business of the country if this bill becomes law.

It should be decisively defeated. Alcohol manufacture and distribution are already hedged about with enough rules, regulations and restrictions without being subject in addition to the whims, caprices and emotions of prohibitionists who have no sympathy with the industry.

Hearings on the bill were begun last week and will be resumed on Jan. 7. Senator Reed of Missouri did yeoman service in behalf of the industry, but reinforcements will be needed if the fight is to be won. If the consumers of industrial alcohol will impress the gravity of the situation on their Congressmen, the day will yet be saved. We ought to make it clear to our federal law makers that prohibition is one thing and industrial alcohol another.

Misleading Trade Terms

TRADE designations for chemical products have been found a frequent topic for discussion and there are many who hold that they should be replaced by correct chemical nomenclature. Firmly established by years of custom, any attempt to change these trade names is met with persistent resistance that yields only under the pressure of public necessity, as when methanol was substituted for wood alcohol. Many of the names are sufficiently indicative of the chemical nature of the commodity so that no confusion results and there is much to be said in favor of retaining those.

There are others, however, that are frequent sources of annoyance, dispute and misunderstanding. A particularly flagrant example may be cited in the case of certain tin salts. Two compounds used particularly for weighting silk are marketed as tin crystals and bichloride of tin, the latter being quoted at about half the price of the former. Upon finding that tin crystals referred to the crystalline hydrate of stannous chloride $SnCl_2.2H_2O$, a chemist would be inclined to wonder what might be meant by bichloride of tin and why, if this were simply another form of stannous chloride, there should be such a difference in price. But his chemical training would hardly enable him to penetrate this mystery, for "bichloride of tin" is actually a 50 deg. Bé. solution of tin tetrachloride!

Industrial inertia is a curious phenomenon. Probably a careless assumption that something containing more chloride than tin chloride must be tin bichloride was sufficient to start the practice, but the effort necessary to correct the blunder now would be considerable. The attempt should be made, nevertheless, for the reduction in disputes and misunderstandings that would follow the elimination of these objectionable trade names would more than repay the energy expended.

Is There a Dominant Type in the Making?

Because of Better Training, Will the Student of Today Displace His More Experienced Colleague in the Technical Work of the Chemical Engineering Industries?

IT MAY be another case of Goldie Locks and the three bears. About the only thing the bears seemed to be able to do was to stand up and howl, "Who's been sleeping in my bed?" So the technical man of today may find himself displaced by the product of the chemical engineering courses of today. Then he will sit up and howl," who's been stealing my job?" and Goldie Locks Chemical Engineer of the future may retort, "Why didn't you do your job?"

What kind of man will this chemical engineer be? Perhaps the best way to find out is to examine his program of study and draw such conclusions as may seem to be warranted.

WHAT KIND of men will be doing your job 10 years from now? Perhaps the question had not come to mind and perhaps, now that it has been suggested, it still does not seem to be very important. Nevertheless the question is worthy of serious attention. That man of the future may be your employee. He may be your colleague or, it is even conceivable that by reason of better training he will be your superior. If there is a chance that a man of somewhat different type of training will dominate the production work of the chemical engineering industries, then it will be distinctly worth while to discover his point of strength and his characteristics.

There is no doubt that the technically trained man is gradually displacing the man whose only degree is from the University of Hard Knocks and Practical Experience in the production work of industry. To prove this point, consider any single organization. Ten years ago there were probably some technically trained men in the production personnel, but today there are definitely more. This will be the case except with those very few companies that had a 100 per cent technical organization 10 years ago. This does not mean that men will not rise from the ranks as they always have, but it does mean that there will be fewer of them that rise through the production and technical mill to positions of executive responsibility. The competition will be keener for a given position and the practical man will find himself at a greater disadvantage.

Let us therefore consider this technically trained man of the future. What qualities will he possess that will permit him to command the better jobs and even perhaps all the jobs? Probably this question cannot be answered, but some light may be shed on the subject if we analyze the curriculum through which he passes. The ideals of the technical schools of today are the surest criterion of the technical men of the future.

In carrying out this study we have singled out four schools in which chemical engineering is taught. Each is typical of a method and a theory of instruction. Each represents a different attitude toward chemical engineering and a different method of organization. The first article of the series, published in this issue, discusses the chemical engineering course at the University of Michigan. This is a course for undergraduates at a large university. The second article will also discuss an undergraduate course at Massachusetts Institute of Technology, a technical school. It is hoped that the third article will analyze a graduate course in chemical engineering such as that at Columbia and that the other article will deal with chemical engineering at a college as exemplified by Penn State. Following these there should be a summary article presenting some few conclusions. It is not implied in selecting these particular schools that they represent the best of their type. Whether they do or not is not the concern of this inquiry. We are trying to discover basic principles that can be true only if these schools fairly represent their types or the ideals toward which that type of school should be trending.

Chemical Engineering at Michigan

A Critical Analysis of the Curriculum and an Estimate of Its Significant Points

By Charles Wadsworth, 3d
Managing Editor, *Chem. & Met.*

NOT infrequently the chemical engineering department of a university is somewhat like a poor relation. It receives the hand-me-downs and the cast-offs of other departments as far as equipment and space are concerned. In this respect the department at Michigan enjoys unusual prestige. It was established in 1897 in the College of Engineering under the direction of Prof. E. D. Campbell, whose metallurgical work has won for him national distinction. The growth of the department has been possible because of the active support of Dean Mortimer Cooley of the College of Engineering, who foresaw the possibilities in the field and insisted that it have adequate support. But no one has contributed so significantly to the development of the department and the curriculm as its present head, Prof. Alfred H. White, who has been a member of the department since its founding.

The present building was completed and occupied about a year ago and represents the last word in physical equipment for teaching chemical engineering. The major features are shown in the photographs and need not be further elaborated here.

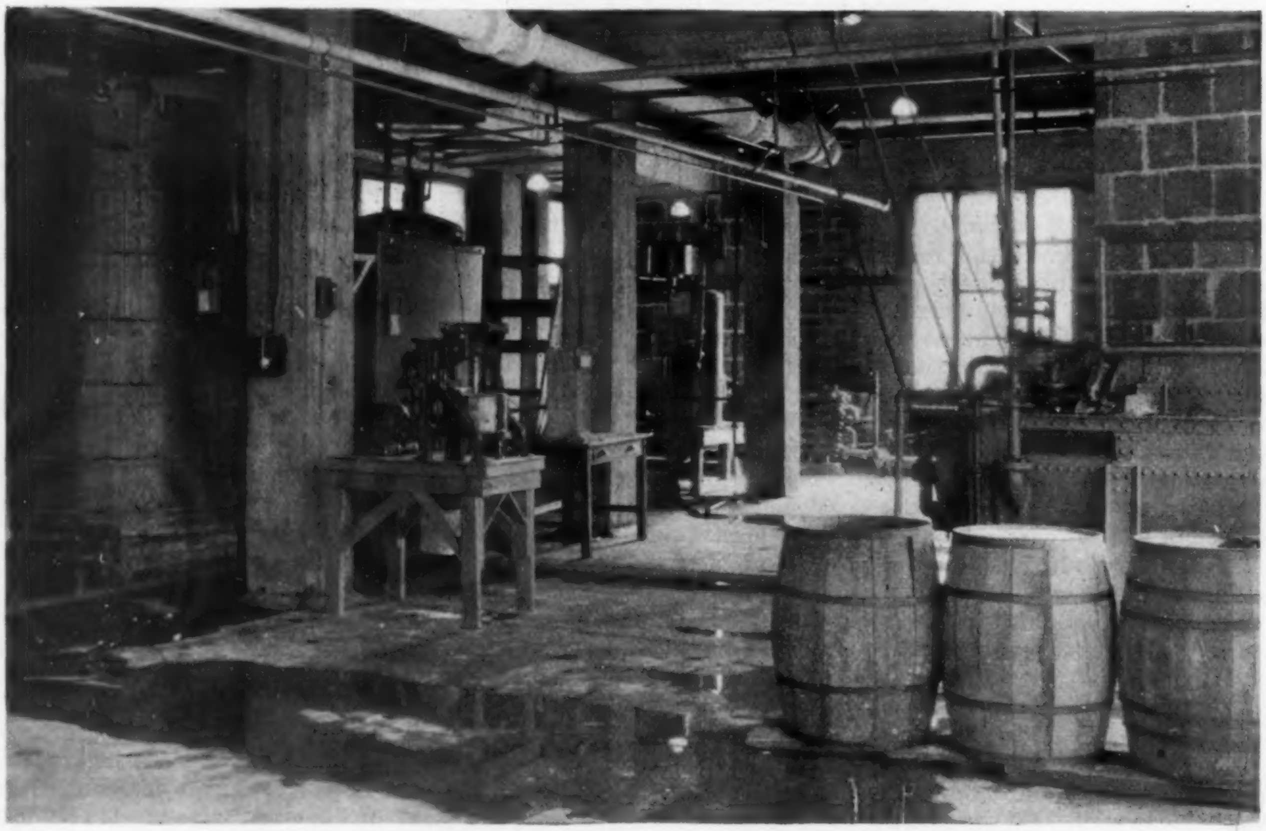
It is an easy step in logic to conclude that because of the exceptional building and equipment there must be a meritorious staff. No university would invest heavily in a weak department. Under the leadership of Professor White a seasoned, experienced staff has been built up—nearly every member having had industrial experience of some kind. This is important, as it gives the staff an appreciation of the problems that beset the young engineer and in a measure explains the method and theory of the instruction. Perhaps an analogy may help to show what this is. After a child is taught the motions of swimming on the end of a rope, the rope is removed and he must swim alone while the instructor looks on. That is the Michigan system in chemical engineering. Teach the technique for three and a half years and then put the student up against a typical industrial problem. This he must work out under the direction of one of the staff, but with as little help as possible. It helps the student to answer the question, "Can I swim?" It gives him confidence—it is a bit of industrial experience transported inside the college.

The technique of chemical engineering is taught through courses that divide themselves into two groups. The first group—the preparatory group—is common to all engineering work at Michigan; while the second includes the special studies that constitute the professional courses in chemical engineering.

Perhaps the most striking thing about the preparatory group is the emphasis on modern languages. A reading knowledge of one language is required for a bachelor's degree in engineering, and this is usually German for the chemical engineer. To facilitate this, four courses (2 hours per week) are set aside for modern languages in the curriculum. (Throughout this

Two Features of the New Building

The main floor of the foundry is on the top floor, which allows a monitor roof and abundant light and air. It also prevents considerable nuisance in the neighborhood, since the fumes are discharged at a high level from the ground. The cupola is shown in the far end of the picture. The charging floor is in the balcony and is served by a freight elevator inclosed in the tile partition at the left. At the right of the rear of the picture are the brass melting furnaces. Since the picture was taken an electric brass furnace has also been installed. At the left of the picture is the sand blast machine with the automatic molding machines. A traveling crane traverses the whole length of the main bay. The picture does not show the core ovens, which are in the front of the room. The foundry laboratory adjoins this room.



A detail of the second floor general laboratory showing the crystallizer on the right with a little centrifuge to the left, used in studying the crystals taken from the crystallizer. In the left-hand corner are tanks, and in the rear a water-softening unit of the zeolite type. The piping system also shows up well.

article courses are referred to in terms of credit hours per week for the whole academic year. Therefore, a 3-hour per week course lasting a half year would be called 1½ hours, the requirements for a bachelor's degree at Michigan being 70 hours, according to this system.) If the reading knowledge is gained before these courses are utilized, they may be switched to cultural studies in other fields. This language requirement is inflexible, as it is one of Dean Cooley's cardinal principles. The other courses in this group are usual with perhaps two unusual features. The first is the emphasis on English composition, which does not stop with the two required courses but is carried on in the chemical engineering courses with the idea of helping the student to write a clear report of technical problems. The second is the shopwork in metals, which serves as a practical introduction to later courses in materials and metallurgy. It is unique because of the remarkably equipped metal shops with a modern cupola, up-to-date handling equipment, annealing and treating furnaces and many other pieces of equipment that give the student an insight into metal that would be hard to duplicate.

There is another aspect of this work in metals that deserves attention. It is under the technical control of the metallurgical engineering staff. Practical foremen assist in the work, but the program is laid out and much of the teaching is done by a member of the staff who has no other duties. The student learns the use of pyrometers and of testing machines. If he welds two pieces of metal, he also pulls them apart. If he tempers a drill he also tests the drill in the drill press.

The technical or professional courses fall into three groups—chemistry, engineering and chemical engineering. Chemistry follows an orthodox line with rather less analytical chemistry than most. This is distinctly desirable and much valuable time is saved. There is a great tendency to overestimate the importance of such courses for the engineer, particularly where chemical engineering is under the domination of the chemistry department. There is a decided effort to focus the principles of physical chemistry on engineering problems in the courses given by the chemical engineering staff. This is invaluable to the engineer, as the great weakness in most physical chemistry instruction lies in the neglect of this aspect. It would be better to include both principles and practice in a course given by an engineer.

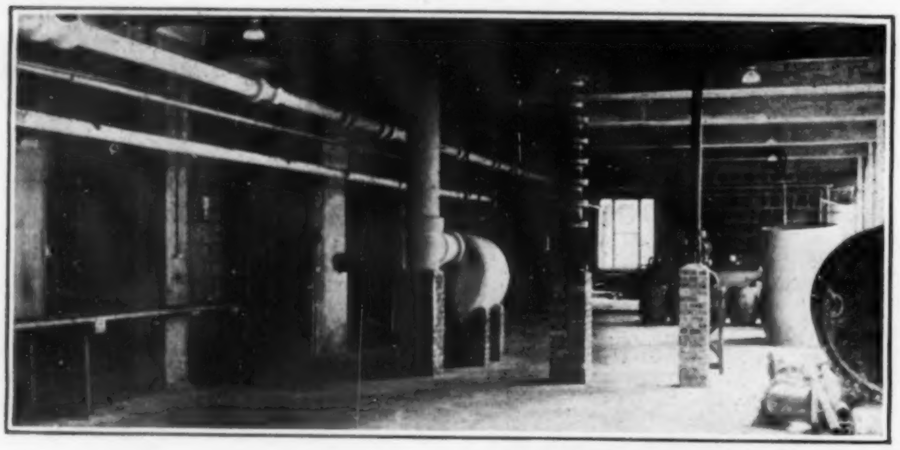
The engineering courses themselves are for the most part orthodox. The course in surveying is unusual and comes surprisingly late in the curriculum for a course of such caliber. Mechanics, machine design, heat engineering, electrical machinery and strength of materials are all essentials and the time expended seems to be about average. Less time could be spent on some of these subjects if it were practical to give special courses to the chemical engineering student. This it is usually impossible to do.

Under the department of chemical engineering are about twenty-five courses, including six in metallurgy. Of these, six courses, equivalent to 10 hours per week, are required. They include a course on engineering materials, such as metals and alloys, cements, clay products and protective coatings; a course in fuel utilization and furnace design; a course in metallurgy; two courses in industrial chemistry, and the special problem already referred to. In addition to these courses the chemical engineering students have 6 hours of electives, and almost invariably they choose chemical engineering courses. These options include: evaporation; conveying, grinding and sizing; chemical plant design; heat transfer; drying; distillation and absorption, and others.

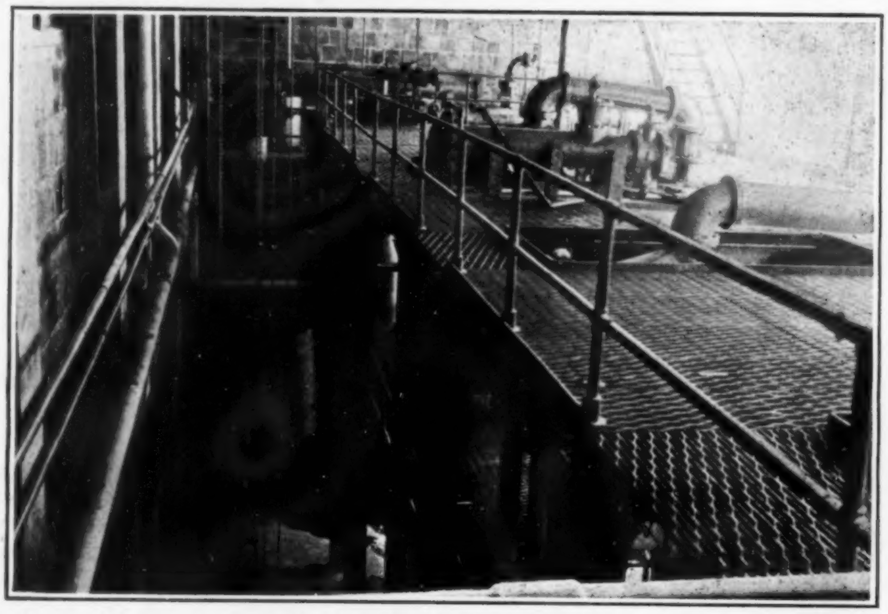
There are many points of interest in this group of courses. For example, the two courses in industrial chemistry do not simply enumerate methods of production of industrial materials. The student is required to work out three problems of plant design of increasing

	1st Year	2nd Year	3rd Year	4th Year	Total Hours	Total Per Cent
English	*English composition* 2			*Engineering english* 1	3	4½
Mod. Lang.	*(See explanation)* 4	*(See explanation)* 2	*(See explanation)* 2		8	11½
Economics			*Principles of Economics* 1½		1½	2
Physics		*General physics* 5			5	7
Mathematics	*Algebra, Anal., Geom.* 4	*Calculus* 4			8	11
Chemistry	*General* 2½	*Qualitative* 2½ *Quantitative* 2½	*Organic* 5 *Theoretical* 1½		14	20
Engineering	*Metal shop* 1 *Drawing and Descrip. geom.* 3		*Mechanics* 2 *Heat engines* 2 *Advanced drawing* 1	*Electrical machinery* 2 *Machine design* 1½ *Strength of materials* 1½ *Surveying* 1	15	21½
Chem. Eng.		*Engineering materials* 1½	*Fuels and Furnaces* 1½	*Metallurgy* 1½ *Inorganic industrial* 1 *Organic industrial* 2 *Special problems* 2½	10	14½
Miscellaneous			*Choice of approved electives* 1½	*Choice of approved electives* 4	5½	8
Total	16½	17½	18	18	70	100

The course in more detail can be seen and studied on the accompanying chart. The numbers that follow the name of the course represent hours per week for a full year (70 of these credit hours being required for the bachelor's degree.) No attempt has been made to evaluate separately the clock and credit hours, for practice is fairly uniform throughout the country both as regards the ratio of laboratory to credit hours and the distribution of laboratory work uniformly throughout the course. It is also worth noting that the required chemical engineering plus the elective courses that are usually chemical engineering total 15½ hours.



The general laboratory on the second floor, showing stills for fractional distillation, only one of them being jacketed when the picture was taken. They are heated internally by electric coils for convenience in measuring the input of energy and also to avoid fire hazard.



The evaporator laboratory with the filter press floor visible in the background. The construction is interesting, the wide well being left to facilitate erection work. The chains hanging in the well are from a traveling crane that traverses the entire room. Two of the three evaporators can be seen, the third being just outside of the picture in the foreground.

difficulty. This of course necessitates the solving of mechanical, chemical and economic problems to the satisfaction of the class, which reviews each problem. The final problem must be answered in the form of a report to a board of directors giving the full economic discussion of the recommendation to locate a plant in a given place and a complete engineering drawing and specification for the equipment.

It has already been mentioned that the courses in chemical engineering take up fully the physical-chemical background of the specific subject, as for example fuels and furnaces; evaporation, filtration and distillation; conveying, grinding, sizing, etc. This is important if the amount of curriculum time given to physical chemistry at Michigan is compared with that given elsewhere, for instead of being low it is probably high. It is the right point of view on physical chemistry too—applied! Many educators, particularly chemists, are inclined to forget that for industry physical chemistry minus application is like a case of tools with a padlock on it. Chemical engineering is more nearly applied physical chemistry than any other single thing, hence the attention to applied physical chemistry is of prime importance.

There are two points of great significance in the Michigan curriculum. The first is its flexibility. Every course in chemical engineering is repeated in each semester. This permits both a convenient program for the student and smaller classes with closer individual attention. The second point is the course, already referred to, called special problems. "To train the student in methods of independent study"—after all, that is the most important thing a curriculum can do. All the technical courses in the world amount to nothing if they cannot be used as tools for original work. Every industrial problem is either entirely or in large measure original work and the student who cannot work without direction is like a rudderless ship. This, then, is the aim at Michigan; to fit the student to carry out an industrial problem on his own initiative before he graduates.

Graduate work is being stressed and the number of students admitted as candidates for the doctor's degree is increasing. This means that time, attention and encouragement are given to research activity. There are many concomitant advantages. It brings the undergraduates into social touch with men more advanced and more mature. It broadens the horizon immeasurably and the out-of-course activities have profound influence on the student's development.

Along this line there is another point that is most important. Michigan is a large university and men are being trained in almost every profession. The prospective engineer sits next to the architect at table and the arts students are his fraternity brothers. This means inevitably that the individual student comes into contact with many points of view and with much that goes on in other lines of effort. Vicariously the student becomes familiar with the great names in other fields and with the methods of thought and action of men in other professions. It is one of the advantages of a university course in chemical engineering.

Common Sense and Common Refractories

An Analysis of the Possible Future Developments in Fireclay and Silica Refractories—Practical Limitations on the Quality of the Product

By M. C. Booze
Senior Industrial Fellow, Refractory Fellowship, Mellon Institute

Special refractories have an indispensable place in industrial plants, but their range of utility is limited. The brunt of the burden must be borne by silica and alumina-silica refractories both by reason of cost and of chemical properties. How much better can these be made and will the extra effort be economically valuable? These are some of the questions that Mr. Booze discusses. There is food for thought here for the chemical engineer.

THE question of suitable refractories for industrial furnaces is being given serious consideration today more than ever before and investigations on this subject are becoming rather common. The increased interest is due largely to the fact that the conditions of service in many furnaces have increased sufficiently in their severity to decrease to a marked extent the life of the material ordinarily used. This shortening of life is often attributed by the consumers to the fact that the refractories now on the market are inferior to those produced in previous years. When it is considered that the business is highly competitive, that the past consumption has not greatly reduced the raw material supply, and that methods are now in use for control of the quality of the product which were not thought of in the past, it must be realized that such an assumption is, except in isolated cases, erroneous.

Some of the underlying causes for the shorter life are the driving of the furnaces to increase capacity; shorter cycles of operation, entailing getting the furnace into production quickly and cooling rapidly when shut down; larger furnaces; reluctance to shut down and make necessary repairs to the linings, which throws a greater burden on the parts remaining; an increased use of low-grade coal; and improper construction due to the high cost of labor and inability to get men who will lay up the linings properly.

Of all the causes enumerated, the increased temperature is undoubtedly responsible for the greatest number of failures. While this is seldom evidenced in fusion or sufficient melting to allow the brick to run, it increases enormously the rate of attack by slag, the amount of vitrification and susceptibility to spalling, and the amount of deformation in the parts supporting an appreciable load. With some products the higher temperature will also result in an appreciable amount of shrinkage, opening cracks in the wall, which accelerate failure.

The steaming capacity of a boiler, the melting time in a metallurgical furnace, the amount of glass taken out of a tank furnace—these are all affected to a very great degree by the temperature of operation. An increase of a comparatively few degrees makes possible a much greater output and consequently the refractories are used to the limit of their endurance.

The cry is naturally for a product capable of carrying this increased burden, one that will have at least the usual length of life when used under the more severe conditions. It was for the purpose of discussing the possibilities along this line that this paper was written.

Consideration is given only to the products made from silica and from various combinations of silica and alumina, since these comprise the major portion of all refractories consumed. It is true that chrome, magnesite, silicon carbide, fused alumina, etc., are almost indispensable in the industries, but their use is greatly limited, due in some cases to the high price and in others to peculiar physical or chemical properties. Some developments may be expected with these latter materials leading toward extended use, but the developments will probably be in the method of application rather than in the products themselves.

In considering the subject of higher quality refractories, and in order to understand what would be involved in their production, it is necessary to have a general idea of the raw materials and manufacturing method used. The products made from fireclay will be considered first, as they are the most widely used.

The principal producing districts in the middle west and eastern part of the country are Pennsylvania, Missouri, Kentucky and southern Ohio, New Jersey and Maryland. Some of these districts are characterized by materials of peculiar composition, but on the whole the differences are more physical than chemical and even these are not sufficient to affect to a marked extent the service rendered, provided, of course, the usual care is taken in selection of the raw materials used and in the manufacturing processes. The variations in composition are not large. In some cases the difference is largely in the free silica content, in others the iron content or the percentage of total fluxes is the distinguishing item. The excess silica and fluxes are, of course, impurities, and lower the refractories of the product. In the accompanying diagram the fusion points of some fireclays have been plotted and a curve is also given, showing the melting points of various mixtures of chemically pure silica and alumina.

In each case the fireclays soften about two cones or approximately 40 deg. C. below the theoretical temperature for mixtures containing pure alumina and silica in the same proportions as exist in the corresponding clays. These reductions are due to the presence of such fluxes as Fe_2O_3, CaO, MgO, TiO_2, Na_2O and K_2O

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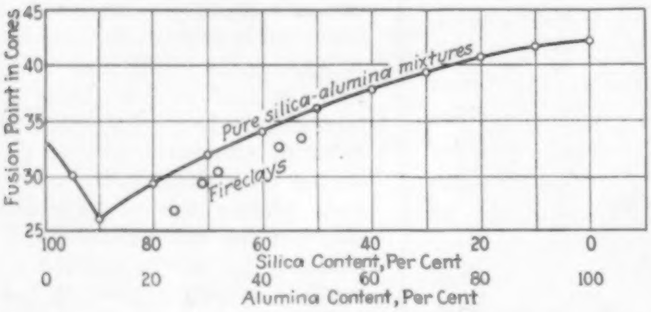
present in the clay as pyrite, siderite, magnetite, magnesite, anorthite, rutile, ilmenite, albite, orthoclase, etc. Their partial removal is possible by weathering, by low-temperature calcination and leaching with acid, and by washing.

In the case of flint clays, however (and it must be understood that the flint clays are as a rule very much superior to the plastic clays and make up about 80 per cent by weight of the clays used in the majority of fireclay brick), weathering or washing has little effect, due to the fact that the lumps are not disintegrated by water.

Even such a simple process as washing and settling out the relatively heavy and coarse accessory minerals is expensive and adds considerably to the cost of the product. Approximately 4 tons of raw clay goes into each thousand brick, which at the present time sell at about $40. Since the tonnage is large, washing would add considerably to the cost, entailing as it does grinding, blunging with water, settling, filter pressing, drying and recrushing. Weathering would remove some of the iron which was present originally as the sulphide



Comparison of Fusion Points of Pure Silica-Alumina Mixtures With Those of Fireclays. The Consistent Increment Is Interesting

and possibly break down some of the feldspars and remove a portion of the alkalis, but the process is slow, requiring storage for a year or more with frequent turning, and the improvement is but slight. By using plastic clay having a fusion point of cone 28-29 and flint clay fusing at cone 33 in the proportions of 1 to 4, fireclay brick are produced which fuse at a minimum of cone 32. Using plastic clay with a fusion point of cone 30-31 and flint clay of the same refractoriness as before, the product will in nearly all cases have a fusion point of cone 32-33 or ½ cone above the less refractory mixture. This corresponds to an increase of about 10 deg. C. It is doubtful if washing or weathering would affect the refractoriness of the plastic clay by three cones, and even then the results would hardly justify the expense.

The statement is often made that a fireclay brick is no better than the poorest clay incorporated in it, and if this were true, a manufacturer could well afford to wash or weather his plastic clay. This holds, however, only when a high proportion of inferior clay is used and not in the majority of cases where the proportion of plastic clay is small.

The processes of manufacturing have an important bearing upon the action of the refractories in service. The fineness of grind, degree of pugging or tempering, method of molding, drying and burning are all important. All of the qualifications necessary in an ideal brick, however, are not affected favorably by changes in the manufacturing methods; fine grinding, molding a dense body and hard burning all increase the strength, reduce the amount of shrinkage in service and lower the amount of deformation under load, but each of the methods tends to produce a brittle material which will spall readily. While the manufacturers may be and usually are familiar with the effects produced by varying the manufacturing processes, they are ordinarily compelled to steer a middle course under the necessity of producing as nearly as possible an "all around" brick.

Disadvantages of Some Raw Materials

In the southeastern states, deposits of kaolin are found that are about as free from impurities as could be desired as far as refractoriness is concerned, the fusion point being about cone 35, or near the maximum limit for clays. This material is being used to some extent in refractories, but it has the disadvantage of being difficult to shrink completely on account of its high degree of purity and its fluffy nature. In one case it is being thoroughly calcined and then made into brick, but at such an expense that the product sells for $250 per thousand.

Numerous attempts have been made to manufacture refractories from bauxite, but this material ceases shrinking only when it has become so brittle as to be very susceptible to spalling and its use has been practically discontinued.

Within the last few years brick made from diaspor have been placed on the market that are of high refractoriness and that have proved to be particularly well suited to certain service conditions. The diaspor, which is a monohydrate of alumina and which as found contains from 10 to 30 per cent of silica, occurs in a limited area at a considerable distance from railroads and is ordinarily found in lenses surrounded by clays of inferior refractoriness, so that the expense of mining it is large and products made from it necessarily command a high price.

It is possible that new and cheap sources of supply of such high-grade refractory materials as diaspor, sillimanite, andalusite, etc., will be discovered, but until they are we must look to the fireclay to furnish the bulk of our refractories and, as has been pointed out, no marked increase in quality can be expected in products made from these.

Silica brick are manufactured from quartzite and lime, the latter being added in small amounts to make the ground "mud" more easily molded, and the brick stronger in the dry and burned state. It also aids in the inversion of the quartz to the more desirable cristobalite and tridymite forms. This type of refractory is noted for its rigidity under load at temperatures even near its fusion point and its use is being extended, replacing fireclay brick in many continuously operated furnaces.

The Medina, Baraboo and Alabama quartzites, from which the bulk of the silica refractories is made, are quite similar in their chemical compositions, containing about 97½ per cent SiO_2, 1½ to 2 per cent Al_2O_3 and Fe_2O_3, and ½ per cent lime, magnesia and alkalis.

The refractoriness is affected by the silica content, but the variations in the rock as selected for refractories are seldom sufficient to have a marked effect upon the fusion point. The strength of the burned brick is determined largely by the grind, the amount of glass present and by the crystal intergrowth. In burning, about 75 or 80 per cent of the quartz is

inverted to cristobalite and tridymite with a considerable increase in volume. The amount of inversion is determined by the temperature and duration of the burn and by the action of the fluxes present, which apparently serve as catalyzers. The lime that is added aids in this inversion, but if the rock used is too pure, inversion will proceed slowly and the strength will be low. The maximum silica content is apparently between 98 and 99 per cent for satisfactory brick.

It is desirable to produce a maximum of inversion during burning in order that the brick will not expand unduly in service. Since quartz has a specific gravity of 2.65, cristobalite 2.33 and tridymite 2.27, it is evident that complete expansion would be reached only when the quartz was all inverted to tridymite.

Variations Due to Kind of Silica

The three crystalline forms of silica named above exist in alpha and beta forms. In the cases of quartz and cristobalite, the change from alpha to beta is sharp and is accompanied by a considerable volume change. The transformation of cristobalite takes place at about 220 deg. C. and of quartz at about 575 deg. C. Because of these sharp and rather large volume changes, silica brick containing either of the two minerals in large percentages are apt to spall if heated or cooled rapidly over ranges including the temperatures given. While tridymite changes from the alpha to the beta form, the transformation is not sharp nor is the amount of volume change as great as with quartz and cristobalite and for that reason brick consisting largely of this crystalline form are not as susceptible to spalling as those in which the other forms predominate.

In the presence of a flux, quartz inverts slowly to tridymite at 870 deg. C., which, in turn, inverts to tridymite at 1,470 deg. C. Without a flux tridymite is not formed, the quartz going directly to cristobalite at 1,250 deg. C. In the case of silica brick, the fluxes are not sufficiently reactive to produce much tridymite, the quartz first changing to cristobalite, which then slowly goes to tridymite on continued heating either in a kiln or in use, provided the temperature is below 1,470 deg. C. An idea of the speed of tridymite formation can be obtained from a paper by J. Spotts McDowell entitled "A Study of the Silica Refractories." In this he shows that a brick of regular grind after one burn at cone 15 in a commercial kiln contained 26 per cent quartz, 4 per cent tridymite and 70 per cent cristobalite. After three burns it contained 16 per cent quartz, 19 per cent tridymite and 65 per cent cristobalite. If tridymite continued to be formed at this rate, he points out that ten burns would be required to produce 80 per cent. If the same changes were accomplished in one burn, the kiln would have to be held at the maximum temperature for weeks with an extremely high coal consumption and considerable damage to the kiln. The spalling properties of the brick would probably be benefited to a noticeable extent by this long burning, but as the difference in specific gravity between cristobalite and tridymite is not large, the amount of increased expansion obtained would be relatively small.

Patents have been obtained covering the use of certain catalyzers that increase the rate of tridymite formation. When incorporated in the brick, the results have not been encouraging. It is also proposed to form the tridymite by the aid of one of these catalyzers before incorporation in the brick. This is also covered by patents, and while some improvement may be noted, the cost will, of course, be materially increased, due to the double burning required. It is not possible to say how much the improvement will be if there is any, since no brick of this type have appeared on the market, and consequently no general tests have been made.

In the case of both silica and fireclay refractories, only the items of major importance have been covered and an attempt has been made to show that in some cases efforts to produce a marked increase in quality would meet with little success and that in others the increase in cost would be out of proportion to the results obtained. There are, of course, other improvements possible than those mentioned, but they are considered to be of minor importance.

It is improbable that a refractory will be produced at a moderate cost that is decidedly superior to those now on the market. The improvements that may be looked for will be largely in greater uniformity—in the raw materials used, in the structure and burn, and in the size and shape.

Co-operative Paper Making in France

Following upon the efforts of the Paper Research Syndicate, there has been founded in France a buying consortium for the paper and cardboard industry with a view to supply of raw materials and equipment. The company has a capital of one million francs and an administration council of leaders of the French paper industry.

The object is to render the French industry as nearly independent as may be possible of outside sources of supply of raw materials and in the long run is looking to the development of wood pulp industry in the French colonies which will supply the home industry with chemical and mechanical pulp and probably with the commoner forms of paper as well.

It is purposed also to erect paper-manufacturing plants in various districts in France where conditions are favorable, particularly where hydraulic or hydro-electric power may be used. Notable among those connected with this major industry are the La Haye-Descartes company and the Papeteries Nanterre. The official organ of the syndicate is the *Moniteur de la Papeterie Francaise*, which was founded in 1864.

Industrial Consumption of Oxygen in England

Some very illuminating figures were recently given by Prof. G. T. Morgan, F.R.S., of the University of Birmingham (England), with reference to the production and uses of oxygen.

While Priestley, who enjoyed the distinction of first extracting this gas from the atmosphere, indicated the possible use of the gas for certain medical purposes, only 1 per cent of the present output is thus applied. Priestley also suggested that oxygen might be of service in certain metallurgical operations, such as the melting of platinum. Today 3 per cent of the annual output of 300,000,000 cu.ft. in Great Britain is used for limelight and for research work, while engineering operations account for the consumption of no less than 84 per cent of this large output, 59 per cent being used for metal cutting and 25 per cent for welding purposes.

Operating a Modern Cracking Plant

How the Dubbs Oil-Cracking Process Functions and Some of the Commerical Results Obtained by Proper Control of This Equipment

By Jacque C. Morrell
Chemical Engineer, Universal Oil Products Co., Chicago, Ill.

CRACKING heavier oils than gasoline has assumed the importance of a necessary factor in modern refinery practice. In the general scheme of oil economy no well-planned refinery would leave out of consideration the installation of a cracking process for the conversion of heavier oils into motor fuel. Indeed, the cracking process may be looked upon as a balancing or equilibrium factor. No longer is it necessary for the refiner to pay high premiums upon high-gravity crude oil, because even low-grade crude and heavy fuel oil are potential producers of gasoline with the cracking art in its present state. When market conditions are such that gas oil and kerosene become unprofitable to dispose of as such, the cracking process acts as a balance in establishing equilibrium. The full economic utilization of heavy crudes such as Texas-Coastal, Healdton, Smackover, Panuco, Venezuela, Argentine and California, as well as topped crudes and fuel oils, cannot be realized without resorting to cracking.

> Cracking heavy oils to produce gasoline is typical of many other chemical engineering operations. Careful control of temperature and pressure usually determines both the character and the yield of production. The Dubbs process doubtless owes much of its commercial success to features of design, but many of its remarkable results can be traced to the thorough system of operating controls discussed in this article.

The limitations of vapor-phase cracking and the catalytic processes for gasoline production in the present state of development are well known. The use of shell stills of various types requiring direct firing or application of heat externally is limited to special distillates of low coke-forming properties. Even under the best conditions the fire hazard is great owing to the large quantity of oil undergoing treatment at any one time. High-pressure processes are similarly limited with respect to the type of oil that can be treated. The chief reason for this is the necessary restriction upon the size of the reaction chamber for high-pressure operation, with subsequent low capacity for coke storage.

Principles of the Dubbs Process

(*a*) The cracking reaction and condensation of the cracked distillate are carried on under a generated pressure. Only clean charging stock and reflux condensate from the dephlegmator are passed through the heating coil. The heavy residual oil formed in the reaction chamber is withdrawn continuously from the system.

(*b*) The total amount of oil in the system averages about 35 bbl., and only one-third of this quantity is in the firing zone. Further, no part of the system containing oil is fired directly. This, contrasted with a direct-fired still of the shell type containing from 200 to 350 bbl. of oil, shows a high safety factor.

(*c*) The coke formed is deposited in the reaction chamber. This chamber is insulated and receives all of its heat through the transfer of oil from the heating tubes. No heat is applied externally to this chamber, thus eliminating fire danger to a considerable extent.

(*d*) The operating or conversion conditions are moderate. The average transfer temperature is about 840 deg. F. The usual pressure of 120 to 150 lb. is not as high as that frequently used in steam boiler practice.

(*e*) The process is continuous. The duration of a run is limited only by the storage capacity of the reaction chamber. The normal capacity of this chamber is more than 30 tons of coke.

The standard Dubbs unit is rated at 500 bbl. of raw oil charging stock per day. A capacity of more than 1,000 bbl. per day may be and has been reached with the same type of unit. Fig. 1 shows in diagrammatic form the relative arrangement of the equipment comprising the process and the flow of oil and vapors through it.

The oil-charging stock is pumped from storage to the plant continuously and at a uniform rate by the feed pump *A* in receiver house *B* and is discharged either directly to the heating coil *C* in furnace *D* through the direct feed line *E* or through the overhead line *F* to the dephlegmator *G*, where it is preheated by the condensing vapors. It is sometimes found advantageous in controlling operations of the plant to split the feed between the dephlegmator and the heating coil, and control valves are provided for this purpose. The oil enters at the bottom of the heating coil *C* and flows upward, passing through fifty 4-in. tubes 30 ft. long connected in series by return fittings, forming a continuous coil, and is heated to the required critical or cracking temperature before it is discharged through the transfer line *H* into the top of the reaction chamber *I*. The hot furnace gases from combustion chamber *J* enter tube compartment *K* through ports in the dividing wall and flow downward between the tubes, countercurrent to the direction of the flow of oil in the tubes, into the flue underneath.

The cracking is completed within the reaction chamber without additional heat. The oil separates into residuum or fuel oil, and vapors, and the carbonaceous material liberated by the cracking is deposited in the chamber and forms coke. The residuum is withdrawn from the reaction chamber through residuum lines *L* and passes to the residuum cooler *M*, where it is cooled for storage. The vapors from the reaction chamber pass to the dephlegmator *G* through vapor lines *N*.

The temperature of the vapors leaving the dephlegmator is controlled by the amount of cooling accomplished therein. In addition to a small amount of radiation or external cooling, which is regulated by adjustable ven-

tilating ports in the housing inclosing the dephlegmator, this cooling is mainly effected by the introduction of a portion—or all, if desired—of the charging oil near the center of the column or of a more volatile oil, such as a portion of the pressure distillate product of the process, by pump *O* through line *P* and spray *Q* located in the top of the dephlegmator. A series of perforated pans extending throughout the length of the dephlegmator insures efficient contact of oil and vapors.

This cooling causes a refluxing action in the dephlegmator, and the lighter vapors that pass off are separated from the heavier vapors that condense and gravitate out through the reflux leg *R* into line *S* and, in combination with the charging oil, return to the heating tubes for further cracking.

The use of a pump of the surge, centrifugal or positive piston type to pump the reflux through the heating coil will permit the feeding of all the charging oil through the dephlegmator. An increase of from 25 to 40 per cent charging capacity with a reduced fuel consumption will result. Yields of gasoline considerably in excess of 50 per cent on a single treatment in the process have been obtained.

As an example of what may be accomplished the following may be cited: "In a unit originally designed for 500 bbl. per day charging capacity, 840 bbl. of raw charging stock (Mid-Continent gas oil) was cracked per day, producing a yield of 50 per cent gasoline. The actual fuel oil burned was 1.43 per cent of the charging stock. Similar improvements have been made in the cracking of fuel oil. The reflux pump permits the feeding of the raw oil charging stock through the dephlegmator, thus effecting a marked reduction in fuel consumption."

The light vapors pass from the dephlegmator through line *T* to the pipe coil condenser *U*. The condensate and the uncondensable vapors, or gas, flow from the condenser to the pressure distillate receiver *V*.

The entire system is under a uniform pressure, which is controlled by the discharge of gas from the receiver through line *W*. The pressure distillate is discharged from the receiver through line *X*.

The uncondensable gas and pressure distillate pass from the receiver into the separating tank *Y* for collecting the vapors from a very small portion of the distillate which volatilizes on reducing the pressure.

The gas from the separating tank may be sent to the furnace burners through line *Z* or passed to a gasoline absorption system.

The distillate from this tank flows through the traps *AA* to the storage tanks.

The pressure upon the system is controlled by a needle valve connected with the pressure distillate receiving tank. The nature of the overhead product with respect to gravity and gasoline content is controlled at the will of the operator. This is accomplished by pumping all or part of the charging overhead or recirculating part of the cracked distillate from the receiver. In the latter case, heat removal is effected by the cooling effect of the distillate as well as by its latent heat of vaporization. The pressure control, as well as all other operating controls, is directed from the receiver house by one operator, in charge of one or more units.

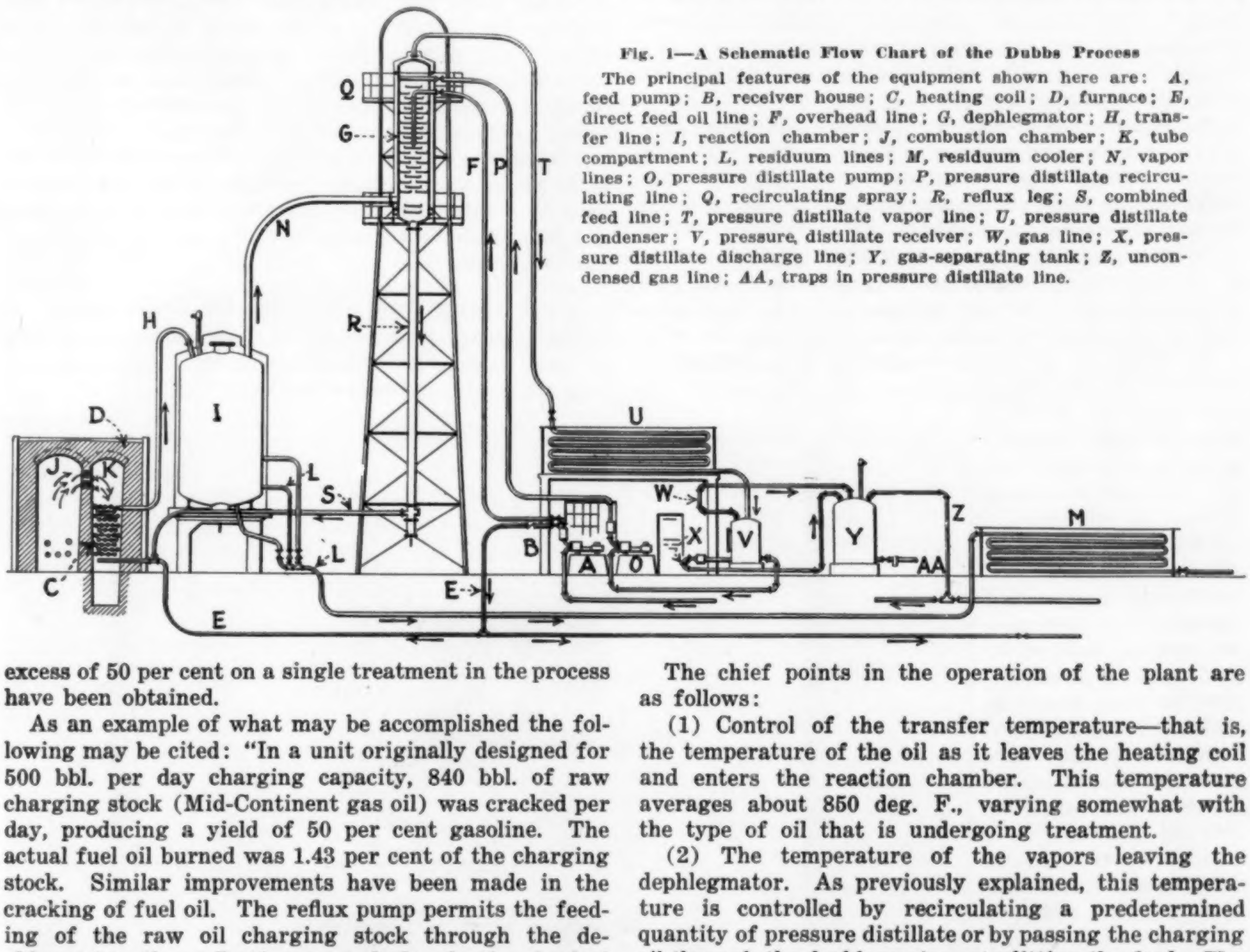


Fig. 1—A Schematic Flow Chart of the Dubbs Process

The principal features of the equipment shown here are: *A*, feed pump; *B*, receiver house; *C*, heating coil; *D*, furnace; *E*, direct feed oil line; *F*, overhead line; *G*, dephlegmator; *H*, transfer line; *I*, reaction chamber; *J*, combustion chamber; *K*, tube compartment; *L*, residuum lines; *M*, residuum cooler; *N*, vapor lines; *O*, pressure distillate pump; *P*, pressure distillate recirculating line; *Q*, recirculating spray; *R*, reflux leg; *S*, combined feed line; *T*, pressure distillate vapor line; *U*, pressure distillate condenser; *V*, pressure distillate receiver; *W*, gas line; *X*, pressure distillate discharge line; *Y*, gas-separating tank; *Z*, uncondensed gas line; *AA*, traps in pressure distillate line.

The chief points in the operation of the plant are as follows:

(1) Control of the transfer temperature—that is, the temperature of the oil as it leaves the heating coil and enters the reaction chamber. This temperature averages about 850 deg. F., varying somewhat with the type of oil that is undergoing treatment.

(2) The temperature of the vapors leaving the dephlegmator. As previously explained, this temperature is controlled by recirculating a predetermined quantity of pressure distillate or by passing the charging oil through the dephlegmator or splitting the feed. The temperature at the top of the dephlegmator averages about 540 deg. F. This temperature is varied with the type of distillate desired.

(3) The pressure within the system is controlled by oil through the dephlegmator or splitting the feed. The excess of uncondensable gas thus removed from the system is returned to the furnace and burned as fuel.

(4) The pressure distillate drawn off determines the level in the receiving tank.

All of these factors are under the direct control of the operator. Pressure gages and instruments for recording temperatures are provided for such control work. Recording instruments are also provided for the furnace, combined feed and residuum temperatures. All of these are installed in the receiver house within sight of the operator. Oil and gas meters are provided for the measurement of charging stock and uncondensable gas. In addition, all liquid measurements are checked by tank gages.

When the operating conditions are settled, the control valves may be set and only occasional adjustments need be made. Although duplicate pumps are provided in the standard installations, the operation is so flexible that even should the charging pumps be shut down for a considerable period no damage will result. The clean reflux passing through the heating tubes will prevent coking up of the transfer line during any temporary emergency.

At the end of a run the coke is removed from the reaction chamber. This is accomplished by means of a coiled or threaded cable, around which the coke is formed in the chamber. The cable is pulled by means of a power hoist, thus breaking the coke into pieces suitable for removing. Preliminary to pulling the cable, the system is drained and steamed.

The Dubbs process has shown some remarkable commercial results with a great variety of oils. All yields are based on a single treatment in the process. The following are cited simply as typical examples of what the process has accomplished:

(1) Four units averaging 62,500 bbl. each, or a total of 250,000 bbl., produced more than 40 per cent gasoline from a 34 to 36 deg. Bé. gas oil. The runs were made consecutively at rated capacity or over.

(2) From the consecutive cracking of 20,000 bbl. of a 25 deg. Bé. Mid-Continent fuel oil an average of 41.5 per cent of gasoline was produced. Equally good results were obtained with a topped crude.

(3) Of a 33.3 deg. Bé. wax distillate 35,000 bbl. was cracked consecutively, and gave an average yield of 42 per cent gasoline. During these runs one unit was operated continuously for 18.5 days (of 24 hours), the throughput averaging 547 bbl. per day.

(4) A series of runs was made upon fuel and gas oil mixtures varying in gravity from 28.7 to 36.6 deg., producing no residual oil—that is, the oil was run to coke and cracked distillate. From 19,000 bbl. of such oil cracked consecutively an average yield of 47.5 per cent of gasoline was obtained. A portion of the gas oil used was pressure distillate bottoms.

(5) Various types of oils from a 9.7 deg. Bé. Panuco residuum to a 40 deg. Bé. California kerosene distillate have been cracked successfully. The presence of water within certain limits if distributed uniformly does not disturb the operation. This shows the flexibility of the process. With an average throughput of 500 bbl. per day, 3,000 bbl. of kerosene distillate was cracked continuously, producing in excess of 50 per cent gasoline. It is noteworthy to point out that no carbon was deposited in the heating tubes. As stated previously, the use of a reflux pump not only increases the charging capacity and reduces the fuel consumption but in addition yields of gasoline considerably in excess of 50 per cent on a single treatment of the charging oil have been obtained. As a matter of fact, a 50 per cent gasoline yield from gas oil is quite usual with present operating practice.

Table I—Summary of Results Obtained by Cracking Various Oils

	La. Topped Crude	Kentucky Fuel Oil	Mexican Distillate	Tarakan Crude (Borneo)	Residuum Venezuela Crude	Panuco Crude	Topped Panuco Crude
Gravity, deg. Bé	28.9	25.5	21.0	18.2	13.4	12.6	9.7
Coke (A.S.T.M. distillation), per cent	3.8	5.1	3.4	5.1	14.1	15.2	18.2
Gasoline obtained, per cent	41.6	43.9	41.65	32.43	26.9	23.7	21.11
Pressure distillate, per cent	60.0	59.7	54.95	60.62	38.5	30.8	26.32
Gravity, deg. Bé	53.6	54.8	53	38.1	48.9	49.7	53.1
Residuum, per cent	34.12	34.5	38.52	28.77	52.2	62.9	66.47
Gr. residuum, deg. Bé	22.0	16.5	5.4	2.1	7.9	8.6	9.2
Coke by wt. of oil cracked, per cent	5.03	6.87	5.62	6.92	7.75	4.48	6.18

Primary Products From Oil Cracking

The primary products from oil cracking are usually referred to as: (*a*) Pressure distillate; (*b*) residuum; (*c*) coke; (*d*) uncondensable gas.

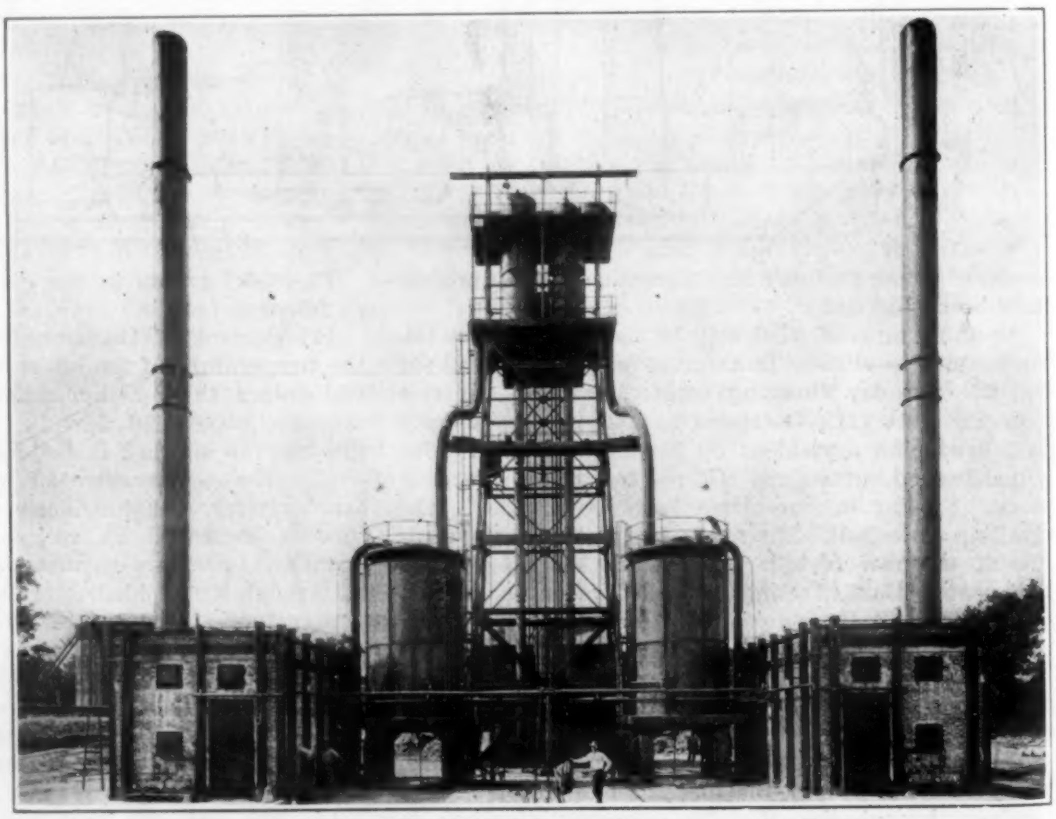


Fig. 2—A Typical Double Unit Installation of Dubbs Cracking Equipment
A photograph taken Oct. 10, 1923, at the plant of the Johnson Oil & Refining Co., Cleveland, Okla.

It is good refinery practice at present to take off a pressure distillate containing from 65 to 75 per cent of gasoline. This holds especially from the viewpoint of maximum gasoline yield and minimum losses in subsequent refining. Under these conditions the operation is easy to control. For the same yield of gasoline the residual oil improves in quality as the percentage of gasoline in the pressure distillate increases.

The pressure distillate varies in gravity from 46 to 54 deg. Bé. depending upon the type of oil cracked and the gasoline content of the pressure distillate. Usually the latter varies from 55 to 80 per cent.

The pressure distillate from all types of charging oils can be readily treated to obtain marketable gasoline. Details for treating have been published by the writer in a previous issue of *Chem. & Met.* (vol. 30, No. 20, May 19, 1924). In general, the pressure distillate is treated with sulphuric acid (66 deg. Bé.); water washed; treated with a solution of caustic soda containing litharge dissolved therein (referred to as plumbite); water washed; and finally distilled in the presence of steam. No sulphur is used in connection with the plumbite treatment.

It is necessary in some cases to wash the gasoline after distillation with a dilute solution of caustic soda. The final caustic wash is applied to render the product sweet and follows all of the above treatment. Under any circumstances it is beneficial to apply this final caustic wash, as a distinct improvement in the odor and stability of the gasoline will result, owing to the removal of decomposition products formed during distillation. This is especially true of cracked gasoline distilled by fire and steam instead of by steam alone. When such a final caustic treatment is applied, it is desirable to water-wash the finished gasoline thoroughly. This not only removes the caustic solution from the gasoline but also traces of dark suspended material formed by the caustic treatment.

As shown in the article cited above on the refining of cracked distillates, certain types of such distillates respond most readily to what might be called a split plumbite treatment—that is, treatment of the distillate with plumbite solution (litharge dissolved in caustic soda)—before and after the acid treatment with intervening water washes. This method is particularly applicable to the cracked distillates obtained from heavy oils of high sulphur content, such as Mexican and South American. Cracked distillates from Smackover and California oils also respond readily to this treatment. In such cases considerable hydrogen sulphide and other water-soluble, undesirable compounds are present and it is advisable to precede all chemical treatment by a thorough water wash. In fact, it is a good general rule both to precede and to follow all chemical treatment throughout the whole operation by water washes of varying periods. Wherever any treatment precedes the acid, such as the following order: water wash, plumbite; water wash, acid; water wash, plumbite; water wash, distill, etc., it is desirable to precede the main acid treatment by a small quantity of acid for the double purpose of preventing dilution of the main acid and to break the suspension formed when treating with plumbite. Wherever such suspensions are formed during the course of any treatment, the water is showered through the distillate rather than agitating, in order to avoid emulsion formation.

Precautions in distillation have been cited in the writer's previous publication on refining. These precautions refer mainly to decomposition effects owing probably to local superheating and overheating during long periods of batch distillation. For this reason continuous distillation has been advised. It has been found beneficial, though not necessary, in some cases to distill in the presence of an alkaline solution. The use and methods of application of a small quantity of fullers earth or other like adsorbents in treating unstable or refractory cracked gasolines for slight color removal after all of the above treatment is applied has been previously cited by the writer.

Character of Residuum

The cracked residual oil withdrawn from the chamber has very desirable fuel characteristics, including a low cold test, low viscosity and high calorific value. The physical characteristics of the residuum vary as a function of operating factors. As previously noted, the residual oil improves in quality as the percentage of gasoline in the pressure distillate increases. This, of course, implies the same yield of gasoline in both cases. The reason for this is very simple. For the same yield of gasoline where the pressure distillate contains a higher percentage of gasoline, part of the heavier ends or higher boiling point components otherwise found in the pressure distillate remain in the residuum, thus decreasing its viscosity as well as improving its general characteristics. It

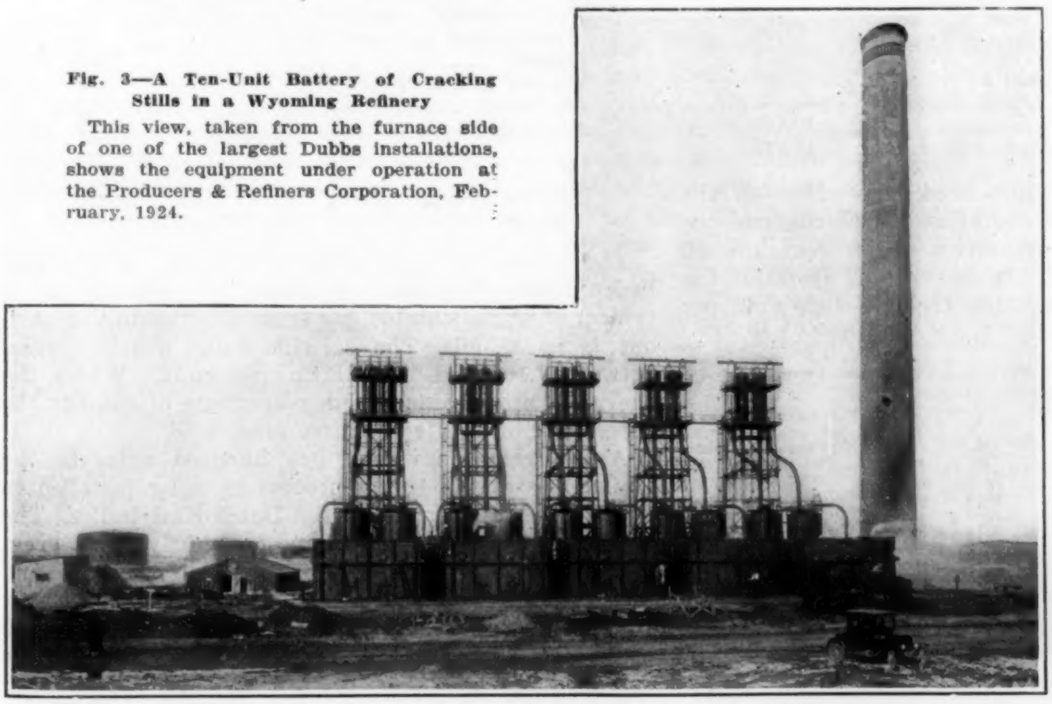


Fig. 3—A Ten-Unit Battery of Cracking Stills in a Wyoming Refinery

This view, taken from the furnace side of one of the largest Dubbs installations, shows the equipment under operation at the Producers & Refiners Corporation, February, 1924.

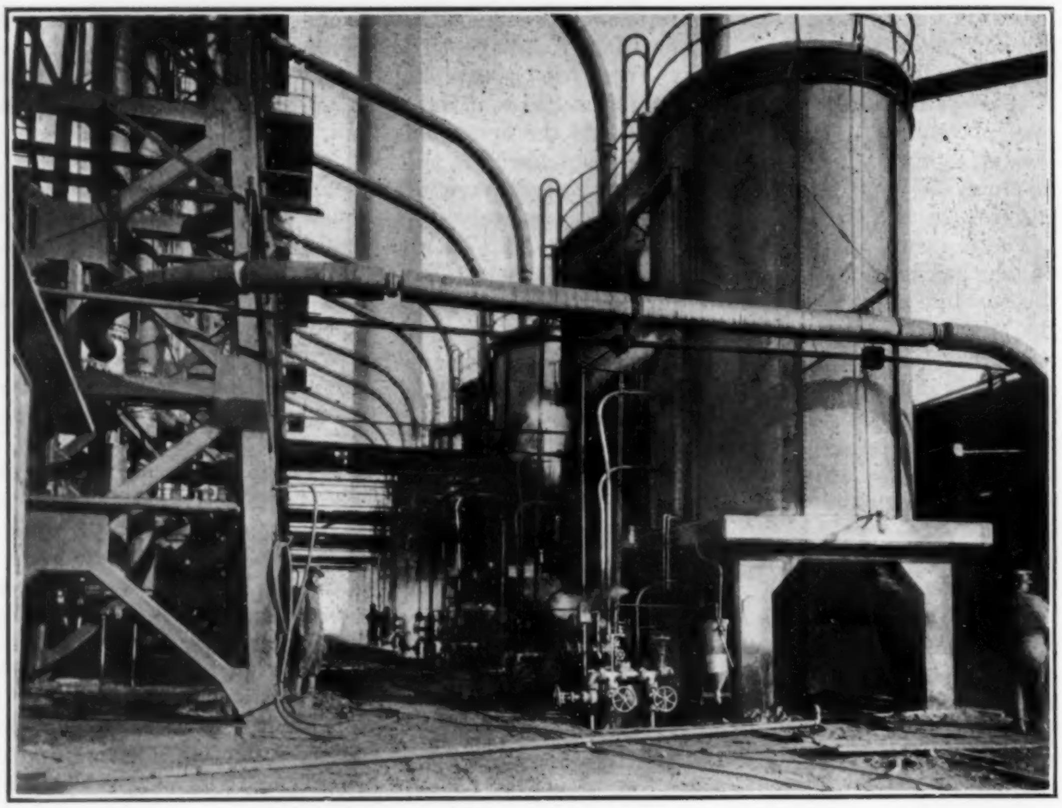


Fig. 4—Another View of the Ten-Unit Battery in Operation

The capacity of this installation is slightly more than 5,000 bbl. per day. Each unit charges 950 gal. per hour of "long residuum" and yields 750 gal. of pressure distillate.

naturally follows that as the percentage of pressure distillate removed from the system is increased beyond a certain point, the quality of the residuum is affected adversely.

The coke produced in the process when operating conditions are properly handled is porous, firm and dry. The ash content is low. The calorific value varies between 15,000 and 16,000 B.t.u. per pound. Its properties render it an excellent fuel and withal a valuable by-product of the process.

The volatile matter content varies, and without proper precautions may be considerably in excess of 10 per cent, depending upon operating conditions; for example, if the plant is allowed to cool too much before releasing the pressure and steaming, the volatile matter is increased. On the other hand, there are other limitations that make it inadvisable to discharge the chamber too quickly after a shut-down. The percentage of sulphur in the coke varies with and is directly dependent on the sulphur content in the original charging stock.

Analysis of one type of this coke is presented in the following table:

	Per Cent
Moisture (as received)	0.45
Volatile matter	3.75
Fixed carbon	94.60
Ash	0.84
Sulphur (oxygen bomb)	0.36
	100.00
Calorific value, B.t.u. per pound	15,625

The quantity of coke produced, depending on the type of oil cracked, the operating conditions and the manner of treatment, varies from ½ per cent upward by weight of the raw oil. In one type of operation the cracking of 24 to 26 deg. Bé. fuel oil with a 42 per cent gasoline yield produced 10 tons of coke from each 1,000 bbl. of oil cracked.

Table II—Characteristics of Residuum Obtained From Various Charging Stocks

	Bé. Gr.	Cold Test, Deg. F.	Visc. Univ. Saybolt (100 Deg. F.) Sec.	B.t.u. per Gal.
Mexican gas oil	26.2	—49	50	147,570
Residuum from Mexican gas oil	17.4	—45	66	147,670
Mid-Continent fuel oil	27.0	+56	181	149,190
Residuum from Mid-Continent fuel oil	20.6	— 2	205	145,870
Burkburnett fuel oil	23.2	+63	347.5	148,080
Residuum from Burkburnett fuel oil	21.2	— 4	144	148,380
Louisiana fuel oil	14.0	+36	10,257.0	157,850
Residuum from Louisiana fuel oil	4.0	—20	123.0	....

Morrell and Egloff, *The Refiner & Nat. Gasoline Mfr.*, vol. 2, No. 4, April, 1923

It is noteworthy that in a run made upon Panuco topped crude the viscosity of the residium was reduced from 2,265 Saybolt Furol seconds (122 deg. F.) to 371 seconds.

Gas of High Calorific Value

The amount of uncondensable gas produced per barrel of oil cracked averages about 200 cu.ft. measured at atmospheric pressure. This uncondensable gas makes an excellent fuel and is generally used for that purpose in connection with the cracking operation.

A typical analysis of this gas from a Mid-Continent fuel oil follows:

Carbon dioxide plus hydrogen sulphide	0.8
Unsaturated hydrocarbons	8.3
Oxygen	0.5
Carbon monoxide	0.4
Hydrogen	5.2
Saturated hydrocarbons (by difference)	84.8
	100.00
Specific gravity (air = 1)	0.856
Calorific value, 1,320.00 B.t.u. per cu.ft.	

The above analysis with respect to unsaturated hydrocarbons, hydrogen and saturated hydrocarbons is typical of uncondensable gas from the cracking of various types of oils. The calorific value usually varies between 1,100 and 1,300 B.t.u. per cu.ft. Where the charging oil contains a high percentage of sulphur the percentage of H_2S is of course greater.

Aside from more than one hundred units in the United States the Dubbs process is being installed in South America, Japan and the Dutch East Indies. The process owes its commercial success chiefly to its great flexibility, with respect both to ease of operation and to the wide range of oils that can be handled with it. Other factors of importance include the high yield of gasoline produced in one throughput and its low operating costs.

Corrosion of Underground Pipe Lines

First Progress Report of an Extended Investigation Indicates That Soil Conditions Are a More Important Factor Than Pipe Materials

By K. H. Logan
Electrical Engineer, United States Bureau of Standards

HAVING frequently encountered serious corrosion of underground structures, the cause of which was uncertain, the electrolysis section of the Bureau of Standards started, in 1921, an investigation of the relation of soils to the corrosion of pipes, for the purpose of determining under what conditions the soil tends to destroy buried structures.

The primary purpose of the investigation was to obtain data directly applicable to the interpretation of corrosion observed in connection with electrolysis surveys. For this purpose it seemed best to approximate, as nearly as possible, conditions encountered by public utility and other pipe-owning companies, by selecting samples of available pipe material from stock and burying them in such sites as are frequently encountered by utilities. The first specimens were buried March 1, 1922, and the burying of specimens continued irregularly throughout most of the following year. Six identical groups of specimens were buried in each of forty-six locations, in order that a group could be removed from time to time and the progress of the corrosion observed without interfering with the specimens that were to be uncovered later.

> The importance of soil corrosion can scarcely be overestimated. The petroleum industry alone has 75,000 miles of buried pipe lines. The gas industry and other public utilities probably have even more, and practically every plant has some steam, water, oil or gas lines subject to soil corrosion. The bureau's investigation began in 1921 and only tentative conclusions are now possible; yet these hold the ultimate promise of great benefit to our industries.

In order that the initial rate of corrosion might be observed, removal of the first groups of specimens was begun in October, 1923. Other work of the electrolysis section prevented the beginning of this work earlier, and the weather conditions made it expedient to take up the specimens in an order approximately reversed from that in which they were buried. It thus happened that some of them were buried only 1 year, others 2 years. In order to compare the corrosion in different localities it was necessary to reduce the data to a definite rate of corrosion, and this involved the assumption that the corrosion was proportional to the time the specimens were buried. Probably this is not strictly true. The extent of the error due to this assumption will appear after the specimens subjected to longer exposure have been examined.

The specimens upon which this report is based consist of eleven kinds of pipe material, two kinds of lead and a piece of parking cable. The specimens were selected from stock, cut into 6-in. lengths, cleaned in gasoline, numbered and weighed. The cut ends were protected against corrosion by being heated to about 200 deg. F. and dipped in asphalt. The millscale was not removed from the specimens and they received no protective coating.

As soon as the specimens were returned from the field to the laboratory at the Bureau of Standards they were thoroughly cleaned by scraping and by soaking in a hot solution of ammonium citrate. This procedure removed the rust, but did not materially affect the millscale except where it had been loosened by corrosion. There has been, however, a slight loss of weight due to loss of millscale in handling and cleaning. This loss is not sufficient to be of any importance.

An examination of the specimens after cleaning shows several distinct types of corrosion with intermediate varieties. Specimens from a few locations look as if they had been immersed in dilute acid. The millscale is almost entirely removed from them and the surfaces appear bright and smooth, with few or no pits. In other locations the millscale is partly removed, and large, bright, very shallow corroded areas appear. These have been spoken of as "blotches." Specimens from one certain location show rather deep narrow channels, or grooves, irregular in form and with sharp edges. In a few locations the corrosion takes the form of numerous small, deep pits, and in others the pits are few in number, but larger and deeper. A considerable number of specimens show little corrosion, except at one end or on one side, while on specimens from other localities the corrosion is fairly well distributed. The character of the corrosion seems to have some definite relation to the soil or locality where the specimens were buried, since in general the type of corrosion is similar for all or most of the comparable specimens in any locality. So far there does not seem to be any marked superiority of any one kind of iron or steel for all soil conditions, with the exception of the high-silicon alloy cast iron, which, on account of its mechanical characteristics, is scarcely comparable with the other pipe materials.

It does not seem practical to present the data on the examination in a brief way, which would enable the readers to draw their own conclusions as to their significance. It may be said, however, that so far, of those who have examined the specimens, none has offered a satisfactory explanation of the irregular distribution of the corrosion.

In most instances the specimens were buried from several blocks to several miles from a street railway system. Tests were made for stray earth currents in such places as were suspected and care taken to avoid places where stray currents might influence the results. There is nothing in the appearance of the specimens to indicate effects of stray currents. They were buried 1 ft. apart, and both theory and laboratory tests indicate that there should be no galvanic action between the specimens.

The character of the pitting in some localities seems to point to galvanic action between the pipe material and the millscale at points where the latter was broken,

Extracts from a paper presented before the American Foundrymen's Association, Oct. 15, 1924, and published by permission of the director, Bureau of Standards.

while in other localities the specimens show no evidence of pitting, but a nearly uniform loss of millscale, due apparently to chemical action. In some instances the maximum corrosion is along the weld, and in others it is on the opposite side. A few specimens show the deepest corrosion adjacent to the asphalt that protects the ends of the specimens. This may appear at either the top or the bottom of samples, rarely at both ends of the same pipe. Many specimens show serious corrosion near the middle, with little or no corrosion next to the asphalt. It thus appears that there may be several causes for corrosion and that additional experiments will be required to evaluate these causes.

Soil Conditions Most Important

Conclusions at this time as to the relative merits of the several pipe materials are particularly dangerous and unreliable, because of the short time the samples have been buried and the very limited number of specimens of one kind of material in each locality.

The chief conclusions that may be reached at this time are: that rapid pitting of cast iron, wrought iron and steel may sometimes occur where stray currents are absent, a fact that has often been disputed; that there apparently are several causes of soil corrosion; and that in certain soils serious corrosion of cast iron, wrought iron and steel occurs within 2 years. Rapid pitting of lead also occurred in several cases, but in fewer cases than in the ferrous materials. In so far as the conclusion may be warranted from short-time tests, the results indicate that no one of the commonly used pipe materials tested is generally superior to the others under all soil conditions. On the other hand, the tests seem to show that the pipe material best suited to one soil condition may give a relatively poor showing under a different soil condition. In other words, the soil conditions must be taken into account if the best selection of pipe material is to be made. I wish to emphasize the tentative character of this deduction pending later study of specimens subject to longer exposure. It is hoped that later results of the investigation will bring out the causes for the corrosion observed, permit the predetermination of corrosiveness of soils, and suggest a satisfactory means of prolonging the life of pipe lines.

The next removal of specimens will take place in 1926 and the results of their study will be made public as soon thereafter as practicable.

Telephone Disinfection a Business in Germany

A German concern, known as the "Telephon-Desinfecktions Gesellschaft Neroform m.b.H.," of Berlin W 15, Lietzenburgerstr. 44, has developed a considerable business in disinfecting public telephone apparatus with its preparation "Neroform," probably a form of formaldehyde, says a report to the Department of Commerce. Subscribers pay a relatively small sum against which an agent of the "Neroform" company pays them a monthly visit for the purpose of applying the disinfectant to the apparatus. The preparation carries recommendations of leading bacteriological specialists.

"Neroform" is of course only one trade name of many potential disinfectants. Its effectiveness is given as lasting for 2 weeks as a minimum, but as above mentioned, it is applied about once a month.

Readers' Views

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Design of Column Stills

To the Editor of Chemical & Metallurgical Engineering:

Sir—I have read with interest the article in your issue of Aug. 25, 1924, page 307, by Gerald H. Mains, on the "Design of Column Stills With Continuous Decanters."

Mr. Mains, using Lewis' theory, arrives at the conclusion that the reflux from the decanter should enter the column at a point below the top. By means of a theory which I hope to publish shortly, I arrive at the conclusion that the whole reflux should be returned to the top of the column. Owing to the difference between the two conclusions arrived at by means of two separate theories, I think it will be of interest to re-examine the question from the point of view of Lewis' theory.

Let us assume that the total reflux, $R_c + R_d$, which we shall denote by R_t, is to be the same as that employed in the example given, and that the amount P, and composition x_p, of the product is to be the same also.

The decanter separates the condensate into two portions of composition x_d and x_p respectively, the relative amounts of these portions depending on the composition of the vapor passing over the column. Conversely, we may say that this vapor composition y_c is a function of the amount of decanter-reflux R_d.

For $V_c = P + R_d$

$$y_cV_c = x_pP + x_dR_d$$

Therefore $R_d = \dfrac{P(x_p - y_c)}{(y_c - x_d)}$ and $y_c = \dfrac{x_dR_d + x_pp}{R_d + P}$

If R_d has the value stated in Mr. Mains' paper, y_c is the composition of the constant boiling mixture, and the number of plates required is approximately as calculated therein.

If the column were shorter than this, y_c would be less, and R_d consequently greater and R_c less, R_t, the sum of R_d and R_c, being maintained constant. In spite of this shortening of the column, the product would still have the same composition x_p.

With a still shorter column, R_d would be still further increased and R_c diminished, until a point is reached when R_c disappears entirely and $R_d = R_t$. This condition will evidently determine the least number of plates which can give the required product with the prescribed reflux ratio R_t. It follows very simply from the new theory referred to that the point in the column for which this condition holds good is the same as the "transition point" between the middle and upper sections. To derive this result from Lewis' theory requires a certain amount of juggling with symbols, and it is simpler to proceed in the opposite direction, and examine the properties of the "transition point" itself.

Equations (7) and (9) may be written (assuming constant molar reflux),

$$\frac{dx}{dq} = y_q - x_q - \frac{P}{R_c + R_d}(x_p - y_q) \qquad (7)$$

$$\frac{dx}{dn} = y_n - x_n - \frac{V_c}{R_c}(y_c - y_n) \qquad (9)$$

For the transition point

$$\frac{dx}{dq} = \frac{dx}{dn} \text{ by definition}$$

$$y_q = y_n \text{ and } x_q = x_n \text{ by identity.}$$

Therefore

$$\frac{P}{R_c + R_d}(x_p - y_q) = \frac{V_c}{R_c}(y_c - y_q)$$

$$\text{But } y_c = \frac{R_d x_d + P x_p}{V_c} \text{ and } V_c = R_d + P$$

Therefore

$$\frac{P}{R_c + R_d}(x_p - y_q) = \frac{R_d x_d + P x_p - R_d y_q - P y_q}{R_c}$$

which on simplification, by simple algebra, reduces to

$$y_q = \frac{(R_c + R_d)x_d + P x_p}{(R_c + R_d) + P}$$

$$\text{or } \frac{R_t x_d + P x_p}{R_t + P}$$

From this relation two important conclusions may be drawn:

(1) The value of y_q, which determines the transition point, is dependent only on the *total* reflux R_t and independent of the quantity R_d introduced at this point. (The reason for this is obvious, according to my theory, since it is shown for all cases to depend only on the *composition* of the material introduced.)

(2) When $R_d = R_t$, $y_c = y_q$.
This relation establishes the fact that the transition point determines the minimum number of plates which can give the required product with the reflux R_t.

The conclusion is therefore that the whole of the upper section is unnecessary.

The method of treatment reduces to the identical method used by Lewis. Mr. Mains suggests that the treatment of the "middle" section is an extension of Lewis' theory which "follows closely" the original method. It follows it so closely as to be identical with it. The only difference is one of symbols. The V_c and y_c of Lewis' equations must always, according to the method of deriving the equation, refer to the amount and composition of the material *withdrawn from* the system, and hence naturally include the "P" and "x_d" of the article.

I may perhaps be permitted to mention that the new theory shows that the conclusion mentioned in this letter holds (at least for binary mixtures) for all methods of producing two portions of different composition, such as, for example, dephlegmation, or fractional condensation, and not only for the special case of decantation treated here.

A. LESLIE BLOOMFIELD, B.A., B.Sc.

A. Boake, Roberts & Co., Ltd.,
Stratford, London, E. 15.

To the Editor of Chemical & Metallurgical Engineering:

Sir—Mr. Bloomfield goes to some length in his letter to derive the conclusion "that the transition point" (between the middle and upper sections of the continuous decanter column still discussed in the writer's article) "determines the minimum number of plates which can give the required product with reflux, R_t," and consequently that the upper section of the column is unnecessary. It seems rather obvious that, by using a two-section column where the entire reflux passes through the decanter and then to the top of the column, for a constant product, a minimum concentration of more volatile component in the column distillate will be obtained for any given reflux, also that a minimum number of plates will be necessary. Efficiency of operation, however, is the aim of column still design and not simply the securing of a minimum number of plates.

Effective decantation is the prime requisite of a continuous decanter still. This is secured by the use of a three-section column with a constant composition distillate from the column containing a maximum practical concentration of the more volatile component. With this column, as shown in the equations and examples of the writer's article, a minimum amount of material per unit product passes through the decanter, thus allowing time for separation of layers; a maximum difference exists in concentration of more volatile component in the condensed distillate and in the decanter reflux, which also aids decantation; further, a ready means of controlling the ratio of reflux to distillate is provided, which is essential in handling varying concentrations of feed liquor.

Using the two-section column suggested by Mr. Bloomfield, for the same total reflux, there is a small saving in number of plates, but several times the quantity of liquid would have to pass through the decanter, and the distillate concentration is very much decreased. This large volume of decanter reflux would have to be chilled for decantation and again heated up before returning to the column (for efficient operation), and since the amount of reflux cannot be independently regulated, small changes in feed concentration or in the temperature of the decanter will result in losses from the bottom of the column.

The writer had experience in operating such a column where all the reflux passed through the decanter, and while of course a decanted product would be obtained, there was great difficulty in regulating the column, and at times considerable loss of material through the waste. GERALD H. MAINS.

Wilkinsburg, Pa.

Critical Study of Water-Gas Reactions

Dr. M. W. Travers, F.R.S., recently gave an interesting survey in London of the published figures of experimental researches carried out by His Majesty's Fuel Board and by the research committee of the Institution of Gas Engineers.

Generally speaking, such research has concerned itself with chemical and thermal balance-sheets accounting for the energy and materials involved and utilized. Dr. Travers argued, however, that what was wanted was rather a trading account to show the relationship among the three separate processes—the blow process, the run process and the clinkering process—into which the entire process can be reasonably divided.

By means of a critical examination of some of the available data, Dr. Travers showed that the blow and the run processes do not reasonably balance, this proving that loss of carbon during clinkering is considerable and that the recorded temperatures are too low. As usually no allowance is made for carbon lost other than that in the ash, the amount of carbon assumed to be gasified is always too high. Systematic researches would still seem to be required in which only one factor would be studied at a time. Valuable information would thus accrue as the influence of each variable condition would be revealed. Measurement of the amount of primary air entering the plant would also serve as a valuable check on consumption of carbon in the blow process.

Equipment News
From Maker and User

Keeping Up With Engineering at the Power Show

Splendid Exhibits, Well Presented, Serve to Instruct and Help the Chemical Engineer in the Solution of His Power and Allied Problems

THREE years ago, when the first National Exposition of Power and Mechanical Engineering Equipment, affectionately called the "Power Show," was held, we saw a lusty and a promising infant. Now the third "Power Show," held in the Grand Central Palace, New York, from Dec. 1 to 6, 1924, has fulfilled that promise and the mature exhibition was one from which no one connected with industry could depart without carrying away much of value for his job.

Besides the large and instructive exhibits of equipment used solely by the power plant engineer, there were many displays among the 380 comprising the show that were of primary interest to the industrial plant engineer in general and to the chemical engineer in particular.

Combustion is fully as important to the users of industrial heating equipment and furnaces as it is to the central station. In fact, since a larger amount of fuel is yearly consumed for such industrial purposes than goes to electric generation, these industrial users of combustion should be more interested in heating equipment than are the current producers in the public utility field.

Perhaps the most interesting development trend brought out by the show as far as combustion was concerned was that in the use of pulverized coal as a fuel. Here the new thing is the unit pulverizer, which, although shown and used in the past, has but recently reached the stage of dependability and general utility so that it is beginning to be available for use with small furnaces or single boilers. Among such unit pulverizers shown were the new Raymond Bros. "Imp," the Fuller-Lehigh Co. pulverizer, and machines from the Furnace Engineering Co., the Aero Pulverizer Co., the Erie City Iron Works and the American Pulverizer Co. Although there are no startlingly new developments embodied in the above, the refinements and improvements in design indicate that this method of fuel burning is receiving the full attention that it deserves.

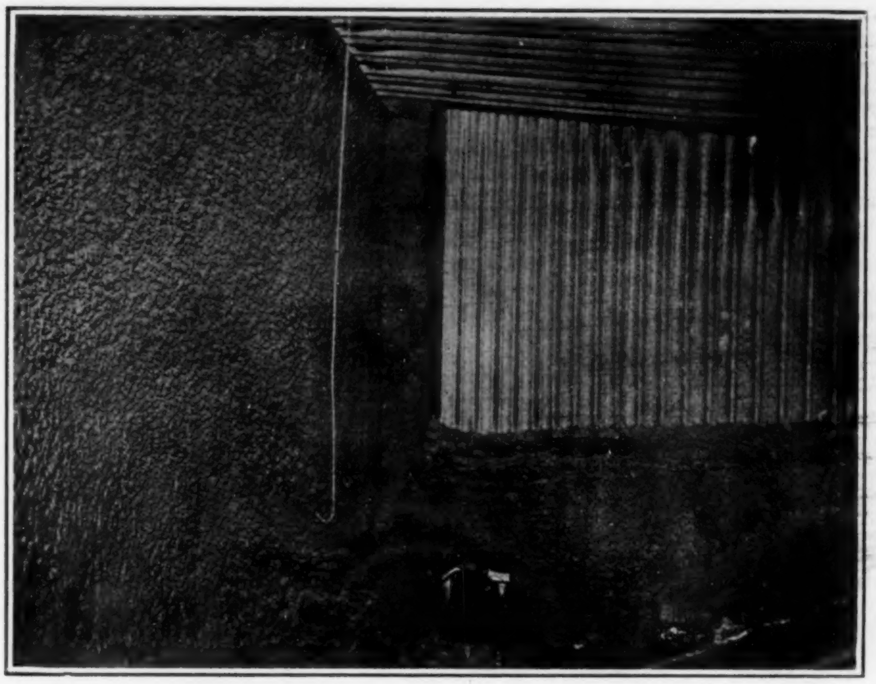
Among other combustion devices shown were many oil burners, devices of peculiar interest to the industrial field, where oil fuel is assuming a position of commanding prominence. The Peabody Engineering Corporation displayed an oil burner designed also to burn artificial or natural gas, making the change from one fuel to another, as is often done in the ceramic and similar industries, easy and simple. This burner is of the mechanical atomizing type and so are many others exhibited by such firms as Morse Drydock & Repair Co., Bethlehem Shipbuilding Corporation, Ray Manufacturing Co., the Engineer Co., the Preferred Utilities Co. and the Schutte & Koerting Co. There were also many stokers of all types shown, but there did not seem to be any developments that were outstanding in these from the chemical engineer's point of view.

Water-Cooled Furnaces

One of the most arresting devices shown at the exposition was the so-called "C-E Fin" furnace wall, a water-cooled furnace wall for boilers and other high-temperature equipment, made by the Combustion Engineering Corporation. This wall has had a thorough tryout at the Hell Gate Power Station in New York, and is now publicly shown for the first time. This furnace wall consists of 4-in. tubes placed vertically on 7-in. centers. Each tube has two longitudinal steel fins welded on 180 deg. apart. When the tubes are placed in the wall, these fins overlap, thus presenting a continuous surface to the radiant heat in the furnace. The lower parts of the tubes are protected by fireclay refractories

Water-Cooled Furnace Wall During Construction

The 4-in. water-circulating tubes and their overlapping fins, the whole composing the furnace wall, are clearly shown in this view. Above the firebox, these tubes curve over and join in a header. At the bottom they are also connected to headers. Through these headers water circulation is accomplished, and the heat recovered by the circulated water can be employed to increase the furnace efficiency.



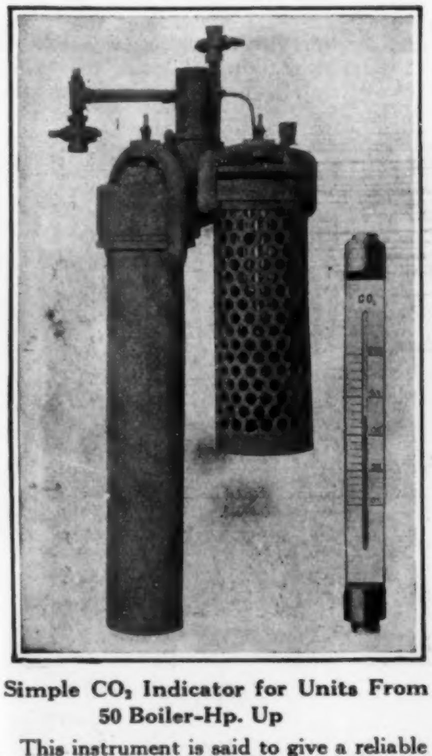
Interior of a Boiler Furnace With Water-Cooled Walls

It will be seen that the water-cooled tubes replace practically all the brickwork of the furnace walls. In addition, they afford considerable protection to the brickwork of the other furnace walls, for they absorb heat reflected by these surfaces and thus lower the surface temperature of these walls. From these two factors arise an elimination of much of the trouble experienced in the maintenance of furnace linings.

to some distance above the fire bed. Water is circulated through the tubes and, in the case of boilers, this water forms part of the regular water circulation of the boiler, the lower ends of the tubes being connected by headers to the mud drum.

Process Control

The control of processes such as combustion and heating is one of the live topics of the day, hence the interest evidenced in the numerous attractive displays of control instruments at the show was not to be wondered at. Most of the well-known makers of such devices were represented by characteristic displays and many exhibited new devices of interest. Recording and indicating instruments for determining the content of CO_2, CO or other gases in a flow of mixed gas were as prominent this year as last. For instance, the C. J. Tagliabue Manufacturing Co. has redesigned its well-known "Mono" type of gas content recorder. This instrument is now operated by a small electric motor and all the glass parts have been replaced by parts of more sturdy material. The new model should prove more durable than have many other CO_2 recorders.

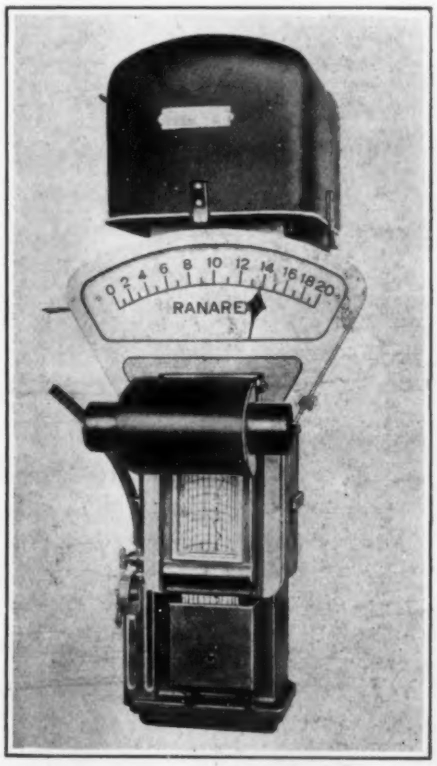


Simple CO_2 Indicator for Units From 50 Boiler-Hp. Up

This instrument is said to give a reliable indication of the CO_2 content of flue gases and is available at such a low price that it should make this type of process control cost for small installations.

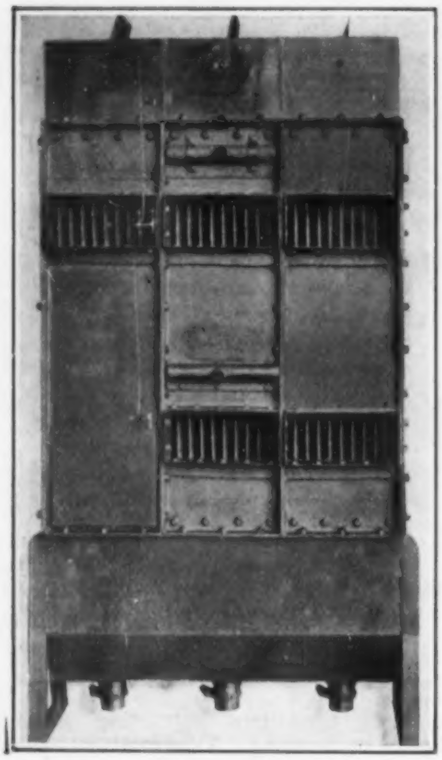
The Uehling Instrument Co. included prominently in a full display of its line of control instruments its new "Apex" CO_2 indicator and recorder, the last instrument having been recently referred to in these columns as constructed for those smaller plants that do not feel that they care to spend the sum necessary for the larger and more expensive devices. The indicator consists of an actuating device or CO_2 meter and a gage or indicator proper. The flue gas flows through the meter continuously, developing a varying pressure within it, the variation being dependent on changes in CO_2 content. This variation in pressure, obtained by the absorption of the CO_2 in a dry cartridge placed in the meter, actuates the indicator gage, which is a manometer of the glass tube type filled with a colored liquid.

A full line of temperature recording and indicating instruments and CO_2 recorders was shown by the Cambridge Instrument Co. This line of instruments, while operating on the same general principles as the original Cambridge and Paul line from England, has now been refined and improved and has been provided with metal cases. The recording instruments are now supplied with forty-day charts. Other instruments in this line include 12 and 35 point distance thermometers of double scale indicating type and a portable, optical pyrometer of the disappearing filament type now attracting much notice in England. This instrument is sighted on the furnace or other hot point the temperature of which is to be measured. It is then adjusted until the filament disappears, when the temperature by means of a gasometer can be read direct on the scale.



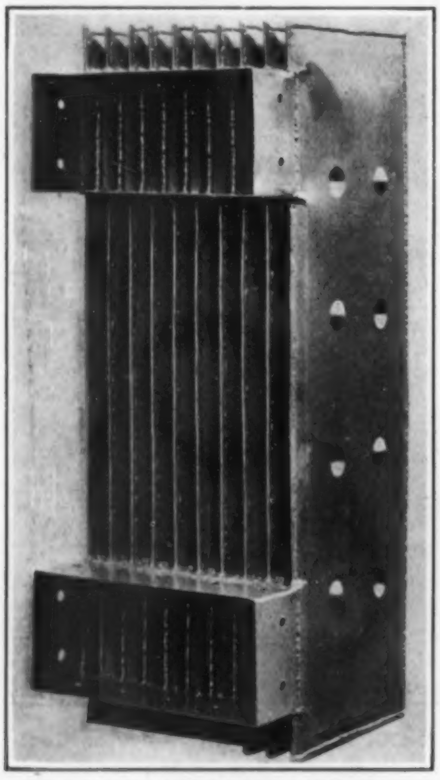
A CO_2 Recorder and Indicator Combined in One Instrument

This instrument is provided with an indicating scale 12 in. wide and has large figures that can easily be read at a distance, thus permitting the fireman to keep the precentage of CO_2 and hence the combustion efficiency of the furnace constantly before him.



View of Air Preheater With Dust Hopper at Bottom and Dampers at Top

This preheater is made entirely from welded plate and is reinforced by means of indentations in the plate itself. Air enters at the upper openings and, passing between the elements, discharges at the lower openings, while the hot gases pass up within the elements.



One Unit of the New Air Preheater

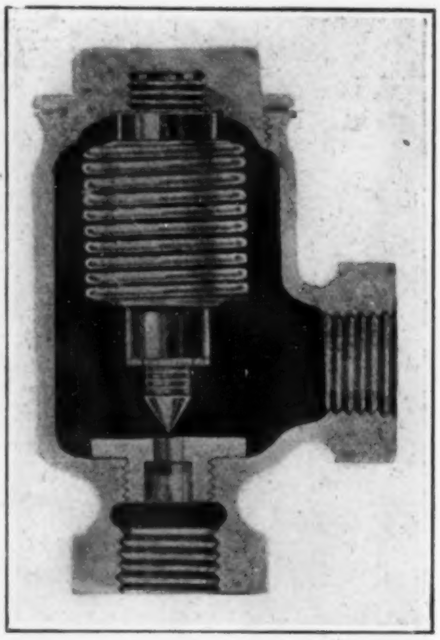
This unit is made up of ten elements. These elements each consist of two plates, welded at the sides, with the ends left open for passage of flue gases. The plates are separated from each other, and the element from those on either side, by the indentations shown.

Another new instrument shown was the "Ranarex" CO_2 indicator and recorder made by the Permutit Co. This is an instrument with a large arc type dial, that should be easily visible to the attendant from any position in front of the boiler. It also has a recorder of the roll chart type embodied in the same case and actuated by the same mechanism as the dial. This mechanism is operated by the variation in weight of flue gases caused by variation in CO_2 content. Two similar fans are turned, in two similar gas-tight chambers, one by flue gas and the other by air, and this arrangement, when the air is held at standard conditions, gives a basis for comparison that is translated into terms of CO_2 content.

Air Preheating

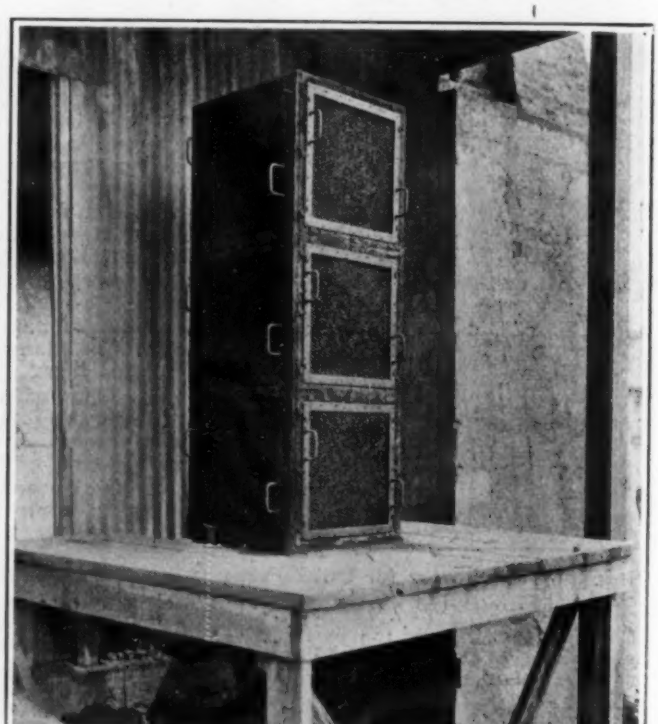
While the preheaters for furnace air are in reality furnace or combustion devices, they can also be used to advantage in heating air for industrial purposes. The well-known designs of the Combustion Engineering Corporation, James Howden & Co. and the Buffalo Forge Co. were supplemented this year by a new design brought out by Connery & Co., Inc. This new air preheater is plainly shown in the two accompanying illustrations. The air enters at the top and passes down around elements through which the hot flue gases are flowing upward. This preheater is constructed in sections so that parts can be removed for repair by removal of the front or rear panel without the necessity of interrupting service or bypassing the rest of the heater. It is also designed so that it may be cleaned without interrupting service. It can be used with any type of flue construction. The internal elements are reinforced and also separated from each other by the indentations shown in the illustration. Deflectors are placed in the air passages at the corners in the rear and these eliminate dead air pockets. This preheater is provided, when desired, with sectional dampers and dust-collecting hopper at bottom with hand-operated gates.

A power and steam heating accessory of universal use is the steam trap, and it is therefore natural that many examples of this device were exhibited at the Power Show. Among these was a new trap shown by the Sarco Co.



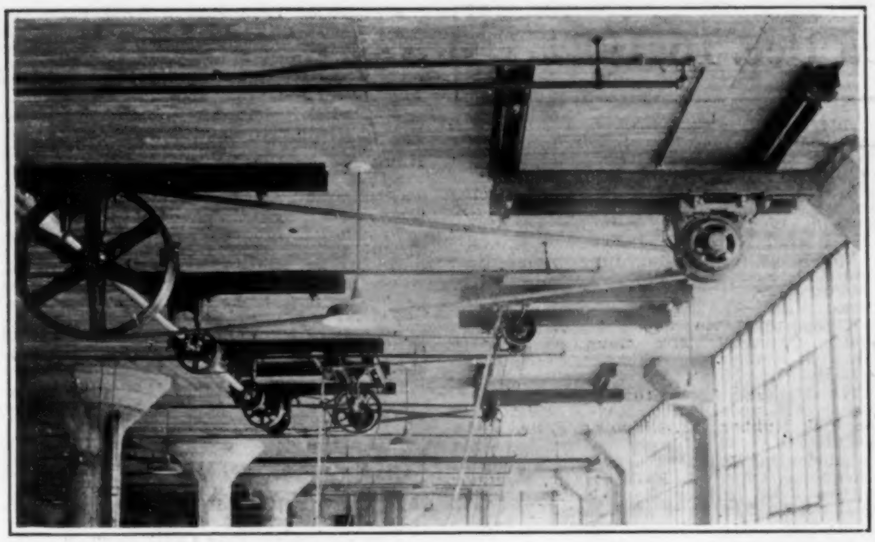
A Steam Trap Adaptable Over a Wide Range

This trap operates on the thermostatic couple principle. The moving part is a bronze tube of seamless construction with a helical corrugation. This makes the tube flexible in a longitudinal direction and, because the corrugation is helical, the movement is uniform. This tubing is the only moving part. The trap is small in size and inexpensive. It can be installed without leveling, merely being screwed into the pipe line.



Air Filter Installation for a Large Air Compressor

This filter protects the 3,500 cu. ft. air compressor of a large Illinois cement manufacture by cleaning the air handled by this compressor.



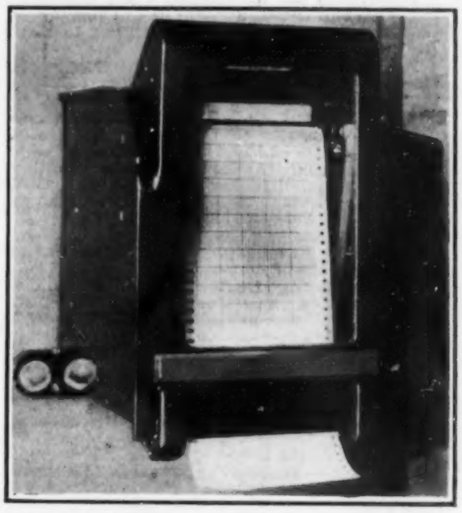
Steel Shapes for Supporting Equipment on Factory Ceilings

that will operate at any pressure over a range from 0 to 100 lb. per sq.in. and which is designed especially for use with steam-jacketed heating vessels, line drips, high-pressure heating coils and for use as a high-pressure automatic air vent. This trap is shown and described in the accompanying illustration.

Among the interesting exhibits not seen at previous power shows was that of the Midwest Air Filters, Inc., and the Midwest Steel & Supply Co. The air filter shown by these companies is of the dry type and comes in units 20x20 in. square, so that an installation of any desired size can be built up. The illustration shows an air filter installation at the intake of a large air compressor. For both air compressors and internal combustion engines, where a supply of dry, clean air does much to increase the life and efficiency of the machine, these filters are very useful. Also, for such industries as have a dust contamination problem, without having a humidity control problem at the same time, the filters provide a means of air conditioning more economical and at the same time more efficient than air washers.

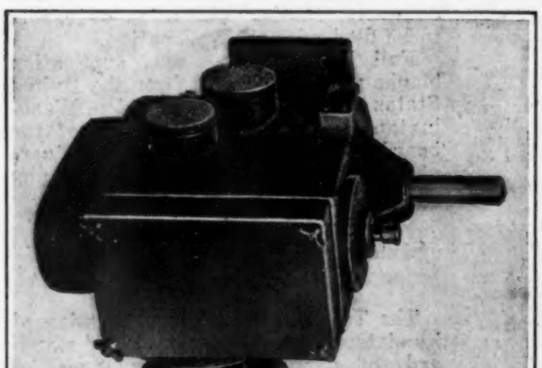
At this same booth was shown also a valuable accessory for factories having the modern type of reinforced concrete construction. In such buildings it is very hard to locate motors, line-shafting, countershafts and other equipment on the ceilings except by means of the familiar ceiling inserts, and these do not permit of the adjustments often needed. So there has been developed a line of light steel sections that readily lend themselves to various needs for anchoring and hanging overhead equipment, being attached to the ceiling by the usual inserts, and that permit of ready adjustment, changing or flexibility of the installation.

The interest in mechanisms for operating valves has greatly increased of late, and this trend was in evidence at the show. Motor-operated valves were shown by the Chapman Valve Manufacturing Co., Charles Cory & Son, Inc., the Edward Valve & Manufacturing Co., the Lunkenheimer Co., the Research Engineering Corporation, the Yarnall, Waring Co., Payne, Dean, Ltd., and others, while at the booth of the Pittsburgh Valve Foundry & Construction Co., the Liberty Electric Corporation had on exhibit a novel device for this purpose. This valve operator, illustrated herewith, consists of a motor, driving through a worm and wheel and gearing, a magnetic clutch and a limit switch. The feature wherein this differs from some other operators is in the use of the clutch. With this, disconnection of the motor is positive and any movement of the valve after the electric circuit is opened is avoided. When the electric circuit is interrupted for any reason, the clutch is automatically released, so that hand operation may be used. A friction clutch is also included that provides protection against emergency. The slip of this clutch is set just below the straining point of the valve or valve stem, so that, if the limit switch setting is wrong for any reason, this friction clutch will slip just before the valve is strained.



Cambridge Recording Instrument in a New Guise

The familiar gas content recording instrument made by this company has been improved in design and is now presented in a strongly built aluminum case, hinged at the top, with special snap locks that keep the interior both dust- and damp-proof. The charts now supplied are sufficient for a 2 months run. The recorder is recommended for determining gas content of CO_2, SO_2, hydrogen, oxygen, benzine, gasoline and other similar uses. It is also built as a recording pyrometer, a millivoltmeter and a microammeter.



Valve Operator With Magnetic Chuck

This device is designed for the control of the valves of a plant from a central station. Due to the safety features embodied in it, it can be arranged for such control through electric circuits and in case the current goes off for any reason or in any other emergency, the individual valves of the plant may be immediately operated by hand.

Manufacturers' Latest Publications

L. J. Wing Manufacturing Co., 352 West 13th St., New York—Bulletin 26A. A new edition of bulletin describing the Wing type E. M. Blower for use in providing forced draft in furnaces burning small anthracite, screenings and slack.

Conveyors Corporation of America, Chicago, Ill.—Bulletin describing the new high duty steam jet ash conveyor of 9-in. pipe diameter size for handling ashes from power plants having exceptionally high tonnages or operating under unusually severe conditions.

Mesta Machine Co., Pittsburgh, Pa.—Bulletin U-2. A new bulletin on Mesta Una-Flow steam engines.

General Electric Co., Schnectady, N. Y.—Bulletin 45609. A catalog of the G. E. surface air cooler, a device for cooling the ventilating air recirculated through turbine-generators.

U. S. Patents Issued Dec. 16, 1924

Flux for Magnesium and Alloys Thereof. John A. Gann, Midland, Mich., assignor to the Dow Chemical Co., Midland, Mich.—1,519,128.

Method of Preventing the Formation of White Deposits of Commodities Canned in Vacuo. Francis Patridge McColl, Ridgewood, N. J., and Walter William Willison, Brooklyn, N. Y., assignors, by mesne assignments, to Thermokept Corp.—1,519,149.

Laminated Tire. Boris Von Loutzkoy, Berlin, Germany.—1,519,178.

Apparatus for Reclaiming Used Lubricating Oil and Fuel Substances. Clement P. Griffith, Fort Wayne, Ind., assignor to S. F. Bowser & Co.—1,519,200.

Airplane-Covering Material. Noble S. Clay, Wilkinsburg, Pa., assignor to Westinghouse Electric & Mfg. Co.—1,519,239.

Attrition Mill. Allan P. Daniel, Springfield, O., assignor to the Bauer Bros. Co., Springfield, O.—1,519,241.

Process and Apparatus for Handling Glass Sheets. Gustav Edward Ericsson, Ford City, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,243.

Roller Table for Glass Machines. Albert E. Evans, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co., Pa.—1,519,244.

Edge Holding Device for Sheet Glass. John H. Fox and Joseph H. Redshaw, Pittsburgh, Pa., assignors to Pittsburgh Plate Glass Co.—1,519,247.

Process and Apparatus for Handling Glass Plates. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,248.

Process for Grading Abrasives. Frederick Gelstharp, Tarentum, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,250.

Plate-Glass-Transfer Apparatus. Herman S. Heichert, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,256.

Process and Apparatus for Making Sheet Glass. Halbert K. Hitchcock, Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Co., New Jersey.—1,519,259.

Process of Making Glass Blanks for Parabolic Reflectors. William H. Taylor, Ford City, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,277.

Method and Apparatus for the Manufacture of Corrugated Board. Kurt Wandel, New York, N. Y.—1,519,280.

Manufacture of Corrugated Paper Board. Kurt Wandel, New York, N. Y.—1,519,281.

Process for Treating Mortar, Cement, and the Like. Kaspar Winkler, Altstetten, near Zurich, Switzerland.—1,519,285.

Oil-Gas Generator. George E. Custer, Providence, R. I.—1,519,295.

Apparatus for Making Sheet Glass. Walter G. Koupal, Tarentum, Pa., assignor to Pittsburgh Plate Glass Co.—1,519,314.

Commercial Ozonizer. James D. Hart, West New Brighton, N. Y., assignor of 45 per cent to Patrick F. Quinn, New York, N. Y.—1,519,373.

Process for Producing Transparent Effects Upon Fabrics. Harold I. Huey, Saylesville, R. I., assignor to Sayles Finishing Plants, Inc., Saylesville, R. I.—1,519,-376.

Alloy. Ernest G. Jarvis, Paterson, N. J., assignor, by mesne assignments, to Merco Nordstrom Valve Co., San Francisco, Calif.—1,519,377.

Process of Making Iodic Acid. Arthur B. Lamb, Cambridge, Mass., and William C. Bray, Berkeley, Calif.—1,519,381.

Alloy. Richard Walter, Düsseldorf, Germany.—1,519,388.

Cap for Liquid and Pressure Tanks. Alfred E. Murphy, Boone, Iowa.—1,519,413.

Device for Separating Solid, Liquid, or Semi-Gaseous Matter From Gases, Vapors and the Like. Julius Alexander Willisch, Deutsch-Catharinenberg, Germany.—1,519,-428.

Method of Generating Hydrocyanic Acid Gas. Charles Sumner Banks, Manila, Philippine Islands.—1,519,434.

Device for Drawing Off Liquid Portions of Desired Densities. William Benjamin Livingston, Chicago, Ill.—1,519,461.

Impregnated Carbon and Process of Making Same. Robert E. Wilson, Cambridge, Mass., and Joshua C. Whetzel, Pittsburgh, Pa.—1,519.470.

Apparatus for Recovering Mixed Salts From Solution. Nathaniel Terry Bacon, Peacedale, R. I., assignor to the Solvay Process Co., Solvay, N. Y.—1,519.476.

Manufacture of Bead Fillers. Joseph A. Bowerman, Wilbraham, Thomas Midgley, Hampden, and Martin Castricum, Springfield, Mass., assignors to the Fisk Rubber Co., Chicopee Falls, Mass.—1,519,482.

Interrelated Process of and Apparatus for Producing Sulphate and Sulphite Pulp. George A. Richter, Berlin, N. H., assignor to Brown Co., Berlin, N. H.—1,519,508.

System for and Method of Producing Sulphate and Sulphite Pulp. George A. Richter, Berlin, N. H., assignor to Brown Co., Berlin, N. H.—1,519,509.

Apparatus for Making Illuminating Gas. Daniel J. Young, Tacoma, Wash., assignor to Young-Whitwell Gas Process Co., Tacoma, Wash.—1,519,523.

Method of Making Tires. Melvon A. Marquette, Chicopee Falls, Mass., assignor to the Fisk Rubber Co., Chicopee Falls, Mass.—1,519,545.

Tire-Building Apparatus. Melvon A. Marquette, Chicopee Falls, Mass., assignor to the Fisk Rubber Co., Chicopee Falls, Mass.—1,519,546.

Lubricating Rubber Surfaces. Melvon A. Marquette, Chicopee Falls, Mass., assignor to the Fisk Rubber Co., Chicopee Falls, Mass. 1,519,547.

Gas-Indicating Device. Willy Nellissen, Bielefeld, Germany.—1,519,549.

Method and Apparatus for Gas Determinations. Samuel Ruben, New York, N. Y.—1,519,555.

Self-Clearing Silencer for Paper-Making Machines. William E. Stewart, South Glens Falls, N. Y., assignor of one-half to Theodore Stoughton, South Glens Falls, N. Y.—1,519,559.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Paving Composition. Charles Swan, San Francisco, Calif.—1,519,560.

Method and Apparatus for Drying a Substance Carried in a Liquid. Rudolph Sucharipa, Prague, Czechoslovakia.—1,519,-561.

Electroplating. Albert Wolf, Geislingen-Steige, Germany, assignor to Wurttembergische Metallwarenfabrik, Geislingen-Steige, Germany.—1,519,572.

Hydrogen-Gas Generator. Arturo G. Fauzon, Cleveland, O., assignor to the Oak Rubber Co.—1,519,607.

Specific-Gravity Meter. Michael Birt Gield, Glasgow, Scotland, assignor to Pneumercator Co., New York, N. Y.—1,519,609.

Primary Breaker. Alexander L. Munro and Harvey H. Rumpel, Milwaukee, Wis., assignors to Smith Engineering Works, Milwaukee, Wis.—1,519,625.

Apparatus for the Extraction and Recovery of Bromine. Henri Tobler, Hackensack, N. J., assignor to American Bromine Co., Maywood, N. J.—1,519,642.

Method of Making Glass Conduits. Frederic L. Bishop, Pittsburgh, Pa.—1,519,658.

Process for Producing Photographic and Other Films. Charles E. Bradley, Montclair, N. J., and John McGavack, Elmhurst, N. Y., assignors to Naugatuck Chemical Co.—1,519,659.

Paper Machine. Enpei Nichina, Tokyo-fu, Japan,—1,519,696.

Dephlegmator. David Charles Brandon, Balikpapan, Borneo, Dutch East Indies.—1,519,719.

Valved-Outlet Equipment for Tank Cars. Thomas J. Entwisle, Henry P. O'Mara and Joseph W. Donnelly, New Orleans, La.; said Donnelly and said O'Mara assignors of eleven forty-eighths to said Entwisle and one-sixteenth to Edward L. Martin, New Orleans, La.—1,519,723.

Apparatus for Making Lead Pipes. Frank B. Ewell, Rochester, N. Y.—1,519,-724.

Rubber Composition. George W. Gish, Atlanta, Ga.—1,519,729.

Air Filter. Friedrich Aus Der Mark, Essen-Altenessen, Germany, assignor to Firm of K. & Th. Moller Gesellschaft mit beschrankter Haftung, Brackwede, Germany.—1,519,739.

Process of Producing Cod-Liver Oil. Edward Mead Johnson, Jr., Evansville, Ind.—1,519,779.

Method of Producing a Solid Smokeless Fuel From Bituminous Coal and Lignite. Clarence S. Lomax, Brooklyn, N. Y., and Wheadon M. Grant, Birmingham, Ala., assignors to Illinois Anthracite Corp., New York, N. Y.—1,519,784.

Method of Damming Flow of Molten Glass. Alexander Samuelson, Terre Haute, Ind., assignor to William R. Root, Terre Haut, Ind.—1,519,802.

Metal Alloy. Barnett Wright Macy, Jacksonville, Fla., assignor to Electric Heating Corp., Jacksonville, Fla.—1,519,862.

Production of Pure Alumina. Heinrich Specketer and Gustav Munch, Griesheim-on-the-Main, and Fritz Rossteutscher, Schwanheim-on-the-Main, Germany, assignors, by mesne assignments, to American Lurgi Corp., New York, N. Y.—1,519,880.

Process of Purifying Fermentation Gases. Gustave T. Reisch, Sausalito, Calif.—1,519,-932.

Pulverizing Mill. Harry R. Collins, Allentown, Pa., assignor to Fuller-Lehigh Co.—1,519,989.

Civil Service Positions Open for Fuel Engineers

The United States Civil Service Commission announces open competitive examinations for the positions of fuel engineer, associate fuel engineer and assistant fuel engineer. Applications will close Feb. 3. The examinations are to fill vacancies in the Bureau of Mines, Department of the Interior, at entrance salaries of $3,800, $3,000 and $2,400 a year, respectively. Advancement in pay may be made without change in assignment up to $5,000 a year for fuel engineer, up to $3,600 a year for associate fuel engineer and up to $3,000 a year for assistant fuel engineer.

Appointees must be able to conduct, under general direction, laboratory and field fuel investigations, especially in combustion, furnace design, smoke prevention, heat transmission, efficiency of fuel-using devices, and must also be able to prepare concise and intelligent reports thereon. They will also be required to assist in tests of boiler and other furnaces and of auxiliary equipment affecting efficiency in the use of fuels, and in investigations of fuel-burning methods and machinery, inspecting and sampling of fuel and compiling of data.

Competitors will not be required to report for examination at any place, but will be rated on their education, training, experience and fitness; and an essay, thesis, publication or report to be filed with the application.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil-service examiners at the post office or custom house in any city.

Sixteenth Supplemental List of Dye Standards

The Treasury Department has issued its sixteenth supplemental list of standards of strength of coal-tar dyes for the purposes of administering the specific duty of 7 cents per pound, which is assessed in the ratio that the strength of the importation bears to that of similar commercial imports prior to July 1, 1914. This supplemental list adds nineteen dyes to the standards, names fifteen others for similitude to dyes previously listed and makes three corrections in lists previously announced.

News of the Industry

Summary of the Week

Cramton bill likely to be amended satisfactorily to users of industrial alcohol.

Tariff Commission report on oxalic acid indicates that increase in duty would be justified.

Commission to look into Muscle Shoals question likely to be named by Congress.

Many lose lives and others are injured when muck dam of Mathieson Alkali Works bursts at Saltville, Va.

U. S. Chamber of Commerce calls conference of industrial leaders to discuss problems of distribution.

Interstate Commerce Commission issues additional regulations for transportation of dangerous substances.

American Engineering Council announces forum for nation-wide reforestation effort.

American interests form corporation to take over control of British nitrate company.

Cramton Bill Likely to Be Amended Satisfactorily

While the industry has not as yet presented its case before the Senate Judiciary Committee, enough has transpired during the hearings on the Cramton Prohibition Bureau bill to indicate that the committee probably will amend the measure in such a way as to make it satisfactory to those engaged in the production and wholesale distribution of industrial alcohol. The insistence of the retail druggist that alcohol be classed with wine and whiskey presents a weak point in the industry's position, full advantage of which is being taken by the radical prohibitionists.

Dr. Charles L. Reese, the president of the American Institute of Chemical Engineers, has been heard briefly, but his comprehensive statement will be made when the hearing reopens Jan. 7. In his brief remarks, he simply called the attention of the committee to the fact that the industry objects to the meddlesome character of police surveillance and to the absolute lack of sympathy always encountered at the Prohibition Unit. He cited instances where permits have been delayed 3 or 4 months. It is particularly difficult, he said, for even the most responsible manufacturers to increase their output quickly, to take care of any increase in the volume of their business, as any departure from the average volume of use is regarded with suspicion. He also objected very strenuously to the promulgation of regulations without consultation with industry, as has frequently been done in the past.

The hearing is being conducted by a subcommittee of the Judiciary Committee composed of the following Senators: Sterling, South Dakota; Butler, Massachusetts; Means, Colorado; Overman, North Carolina, and Reed, Missouri.

The first witness was Representative Cramton, who contended that business is reactionary and does not want to accept any change in its methods. He contended that it would be greatly for the good of industry if all matters connected with the Volstead act were concentrated in one bureau.

J. M. Doran, the chemist in charge of industrial alcohol for the Prohibition Unit, told the committee that 10 per cent of the industrial alcohol released ostensibly for legitimate purposes is diverted for beverage use. He emphasized again and again that the great majority of producers and consumers are entirely scrupulous in their handling of alcohol and that it is because of the bad faith of a small minority that burdensome regulations are necessary. He pointed out that the demand for trade alcohol is increasing by leaps and bounds, due particularly to the export demand, the requirements of the rapidly growing articial silk industry and the vanity trade. Of the 60,000,000-gal. output, about half is denatured through the use of about seventy approved formulas.

Spain Will Become Exporter of Potash

Exports of potash from Spain will begin to move shortly after the new year opens. This will be made possible by the development of the Minas de Potassa de Suria by the Belgian branch of Solvay & Co. It is declared that the operating company is entirely independent of German connections and is bent upon capturing a portion of the American market. This development is expected to have an important bearing on the potash market in this country, as apparently a material source of supply, outside the combine, now exists.

Many Lose Lives When Dam of Alkali Co. Gives Way

A muck dam of the Mathieson Alkali Works on the Holston River at Saltville, Va., burst during the night of Dec. 24, flooding the mill settlement below it. The flood came without warning and the victims, trapped in their houses, were unable to escape. At least nine are dead, twenty or more are injured and many are missing.

A call was broadcast for eye and nose specialists because of the effect of the alkaline muck on the eyes and noses of the sufferers.

No more details were forthcoming at the time of going to press, but it is thought that the death list will be larger, as many of the victims have developed pneumonia, from exposure and immersion in the icy waters.

American Interests May Control British Nitrate Company

The Anglo-Chilean Consolidated Nitrate Corporation has been incorporated at Dover, Del. Capitalization is given as consisting of 125,000 shares of preferred stock with $100 par value and 1,600,000 shares of common stock of no par value. In connection with this incorporation a report from London says that a meeting of the shareholders of the Anglo-Chilean Nitrate & Railways Co., Ltd., has been called for Jan. 2, to sanction an agreement between the company's board and Guggenheim Brothers of New York for the sale of the company's assets for £3,600,000, to be satisfied by 7 per cent mortgage debenture stock of an American company to be formed by Guggenheim Brothers.

In a statement issued by Murray Guggenheim the truth of this report was admitted and he added that negotiations would probably be completed early in January.

News in Brief

Kraft Paper From Tree Stumps—The United States Turpentine Co., Douglas, Ga., has completed the construction of a local plant for the manufacture of kraft paper, and will commence steady production soon. The mill will operate under a special process, utilizing, as raw pulp material, tree stumps from which the turpentine has been extracted. The enterprise is the result of long-time experiment to ascertain a use for this residue. The stumps are obtained from local farm areas and are said to be available in large quantities.

Fertilizer School in Texas—A fertilizer school has been opened at Texarkana, Tex., under the direction of experts of the Texas Agricultural and Mechanical College and from the College of Agriculture of the University of Arkansas, Fayetteville, Ark. The school is the first of its kind ever conducted on such a large and definite scale in the Southwest. It offers instruction for business men, farmers, distributors, salesmen and others interested in the industry. The initial attendance totals 300 persons from the border counties of the states of Texas and Arkansas.

Michigan College of Mines Adds to Curriculum—The Michigan College of Mines, Houghton, Mich., is arranging to add courses to its curriculum in the lines of electrometallurgy and metallography, and will develop comprehensive divisions in these branches. The new courses will be started during the coming year, as soon as the metallurgical building now being erected is completed and equipment installed.

Motor Truck Builder to Open Laboratory—To develop greater facilities for research and investigations, the Graham Brothers Truck Co., Evansville, Ind., manufacturer of motor trucks, has had plans completed for a new metallurgical laboratory, to be located on the Stringtown Road, to be two-story, brick and concrete, 50x60 ft., costing about $30,000, with equipment. Erection will be started soon.

Alcohol Plant Running at Capacity—The U. S. Industrial Alcohol Co., Baltimore, Md., is running at capacity at its commercial alcohol plant in the Fairfield district, giving employment to a full working force. It is expected to continue on this basis indefinitely. The byproduct plant of the company in the same district, opened last July and operated by the U. S. Industrial Chemical Co., a subsidiary organization, is also engaging under a heavy production schedule for the manufacture of potash, ammonium sulphate and other chemicals manufactured from the molasses waste from the alcohol works.

Paradichlorbenzene as Clothes Moth Repellent — A new protection against clothes moths has been found by the Bureau of Entomology of the federal Department of Agriculture in the form of paradichlorbenzene, which has been used in the control of the peach borer.

President Names Conservation Board for Oil

President Coolidge has appointed the Secretaries of War, Navy, Interior and Commerce to act as a board, in co-operation with representatives of the oil industry, to make an investigation of means of conserving the national oil supply. It is explained that the President feels it is apparent that despite the large overproduction of oil in this country consumption is growing larger and it is necessary for the common welfare that the country provide for its supply.

In his letters to the Cabinet officers asking them to serve the President emphasized the fact that at present the country was not facing an undersupply of oil, as the production of 300,000 wells is in excess of immediate requirements. But he took the position that overproduction itself encourages cheapness and wastefulness when the national oil resources are limited. He asked the Cabinet officers to enlist the full co-operation of the oil industry in its study of conservation methods.

"I would express the desire," the President said, "that these conferences may be open and exhaustive. The oil industry itself might be permitted to determine its own future. That future might be left to the simple working of the law of supply and demand but for the patent fact that the oil industry's welfare is so intimately linked with the industrial prosperity and safety of the whole people that government and business can well join forces to work out this problem of practical conservation."

Germans Will Exchange Potash for American Phosphate

Negotiations are in progress for an exchange of German potash for American phosphate. The Phosphatgesellschaft of Hamburg, whose members operate superphosphate plants, is understood to have made such a proposition to American interests. The German phosphate manufacturers previously had secured assurances that the Potash Syndicate would participate.

This is regarded as additional evidence that Germany is continuing to look to the United States for its phosphate, rather than to Algeria and Tunis. The report that the Franco-German commercial treaty might provide preferences for the phosphate coming from the French protectorate has led to scrutiny of the figures covering German imports of phosphate. While there has been a great reduction in the amount of these imports, apparently an increased proportion of the German imports has come from the United States. In the season of 1913-14, Germany consumed 630,000 metric tons of P_2O_5. In the season of 1921-22 the figure fell to 312 tons; in 1922-23 it fell to 295,000 tons, and in 1923-24 to 167,000 tons. Of all imports in 1923, 86 per cent came from the United States. In the first 9 months of 1924, 90 per cent of all imports of phosphate came from the United States. In 1913, only 45 per cent of the imports originated in this country.

Officials of the German Potash Syndicate deny vigorously that there is any effort to secure preferential treatment for French phosphate on the German market. It is pointed out that if Germany accorded France this preference it would lay itself open to like demands from other countries on particular products.

Engineering Council to Push Forest Preservation

Studies of the forestry situation in the various states will be made by national and local engineering societies under the direction of the American Engineering Council, which announces its purpose of working with the federal government to carry out the provisions of the Clarke-McNary act.

The nation's timber resources are thinning so rapidly as to constitute a grave social and industrial menace, according to the Council, which at a forum in Washington, D. C., Jan. 16 and 17, to be attended by delegates from all over the country, plans for nation-wide reforestation effort, the building industry and other agencies co-operating will be publicly discussed.

The Council has appointed a committee on reforestation, which has already begun the work of enlisting engineers in every state in a permanent organization whose investigations shall harmonize with U. S. policy, according to the president of the Council, ex-Governor James Hartness of Vermont.

A survey has disclosed that fourteen states are without forest departments. The most heavily timbered of these are Florida, South Carolina, Georgia, Mississippi and Arkansas.

Appealing for immediate and effective action, the Council has sent to its member organizations a request that each organization make a careful study of the Clarke-McNary act and of the present forestry policy of each state. Changes in state laws that are required in order to bring about compliance with federal policy will be urged.

"The Council," said ex-Governor Hartness, "will enlist the co-operation of all interested organizations in every state in carrying on a campaign for securing the passage of such legislation and changes of forestry policy as will enable the state to co-operate fully with the federal government in carrying out the provisions of the Clarke-McNary act."

High Rail Rates Reduce German Exports of Fertilizers

Germany has lost most of her export trade in mixed fertilizers. The fertilizer manufacturers contend that this is due principally to high railroad rates in Germany. The recent general reduction of 10 per cent in railroad rates is held to be entirely inadequate. They still are 53 per cent higher than were pre-war freight rates. Rates in Austria, France, Italy and Belgium are very much lower than those prevailing in Germany, but the haul in Germany is so long that it all but precludes shipments of mixed fertilizers into those countries. Most of the German fertilizer concerns are converting their capitalization from paper to gold marks.

Washington News

Higher Duty Recommended for Oxalic Acid

After considering the case a year, the Tariff Commission has submitted to the President a report on costs of production of oxalic acid which indicates that the maximum increase under the flexible tariff, 50 per cent, would be justified in changing the rate of duty to equalize costs here and abroad. The report of the commission was unanimous and it is expected that President Coolidge will issue a proclamation increasing the duty from 4 cents per pound, named in paragraph 1 of the 1922 tariff act, to 6 cents per pound.

Two applications for investigation were received by the commission in this case. The Victor Chemical Works, Chicago, applied for an increase in duty. R. W. Greeff & Co., New York City, selling agents for a producer in Holland, applied for a decrease.

After an investigation of domestic plants and in the Netherlands, the commission held a hearing in November, 1923. The data have been before the commission for a year, action having been delayed owing to the wheat and sugar investigations that in that period have absorbed the major portion of time of the commission.

Conference on Distribution Called by U. S. Chamber of Commerce

The Chamber of Commerce of the United States has called a Distribution Conference to be held at Washington, D. C., on Jan. 14 and 15. Invitations have been issued to representatives of large and important industrial groups, who will attend in their individual capacities and not as delegates from organizations.

The principal subject to be discussed is the necessity for a census of distribution comparable to our present census of manufactures. Ways and means will be considered for obtaining data on stocks of basic commodities. The conference will also consider trade relations among manufacturers, jobbers and retailers. Elimination of waste in distribution and a study of advertising methods will also come within the scope of the conference.

In a statement announcing the calling of the conference, Richard F. Grant, president of the Chamber of Commerce, says:

"The problem of distribution cannot be weighed intelligently nor can improvements be made in existing methods until there has been a competent survey of conditions of distribution and a compilation of facts relating to it necessary to a conclusion. This can best be accomplished by those who are themselves engaged in or familiar with distribution. To this end the Chamber of Commerce of the United States has taken the initiative in calling the conference, in the hope that, as a result of the work to be set in motion, reports of a practical nature, upon which future economies and improved methods of distribution will be based, may be made."

A memorandum accompanying the invitations summarizes the general conditions relating to distribution as follows:

"Much misunderstanding exists in the public mind of what takes place in the distribution of merchandise from the producer to the consumer, and periods of high prices exaggerate the causes of this misunderstanding. It is forgotten or not comprehended that every necessary expense attending distribution is greater than before the World War. While prices are about 60 per cent higher, wages are 70 per cent and rents 68 per cent higher. Wages are the largest item of expense in distribution; rents are one of the largest and they, with other necessary expenses, are the principal cause of high or low prices.

"Distributors as a class are alive to their responsibility for efficient service and regard themselves rightly as agents for their customers. For this reason, if for no other, studies of costs and methods of distribution by distributors are being conducted in many trades, but many difficulties are experienced in broadening and making generally effective this work.

"To facilitate these studies of costs and methods; to bring distributors together for a solution of their common problems; and as a result of this discussion to arrive at ways and means finally for establishing the most economical forms of distribution is the objective of the Distribution Conference."

Commission to Look Into Muscle Shoals Gains Favor

The Senate adjourned Dec. 20 for the holiday recess without having disposed of the Muscle Shoals matter. As none of the votes taken thus far on amendments to the Underwood bill has furnished an indication of how the members would vote on a decisive question, it is becoming increasingly apparent that the proposal to refer the entire matter to a commission will be the legislation which finally will be written on the statute books.

As Congress adjourned, public ownership versus private ownership was being argued. As this question presents wide opportunities for discussion, there is no predicting when the debate will be concluded, but it would not be surprising were definite action taken by the Senate shortly after reconvening in January. The decisive vote doubtless will come on the Jones amendment, which provides that tne matter be referred to a commission instructed to report in December, 1925. The commission is to be composed of the Secretaries of War and Agriculture and a third person whom the President will name.

The lengthy exposition of the benefits of public ownership of electrical utilities brought forth nothing new. The Ontario Hydro Commission, as usual, was presented as Exhibit A.

Senator Walsh's amendment giving the Federal Power Commission jurisdiction in the matter of rate regulation on power moving interstate, when the state commissions fail to agree and in case of no state regulation, was adopted over Senator Underwood's protest.

New Transportation Regulations

Additional regu'ations of the Interstate Commerce Commission for transportation of dangerous articles were formally approved on Dec. 12 and are just now being distributed. These regulations provide amended or supplemental instructions on the following subjects:

Packing and marking high explosives and smokeless powder for small arms.

Labeling, etc., for flammable liquids such as paint, shellac, varnish, etc.

Packing flammable liquids such as ethyl chloride.

Use of cylinders and tank cars for liquefied petroleum gas.

Packing, marking, etc., of fireworks.

Standard tests of steel cylinders under Shipping Container Specification No. 7.

Shipping container specification for metal cases of Class A, riveted sheet iron or steel; and for iron or steel barrels or drums.

Specifications for double-wall corrugated strawboard boxes, including special requirements when these are used to hold liquid containers.

A copy of the regulations can be obtained on application to the Interstate Commerce Commission.

Acute Lead Poisoning Report

During the cutting up of certain naval craft that are being demolished at the Brooklyn Navy Yard several cases of acute lead poisoning have been reported. Apparently the armor plate has been very heavily coated with lead compounds by painting and a considerable amount of this lead is volatilized by the cutting torches in a form that produces an acute lead poisoning in the workers unless they are protected from these fumes.

Colonel E. B. Vedder, of the Medical Corps of the U. S. Army, who reported these facts in a recent address in Washington, draws the analogy between these cases of acute poisoning and those which have been experienced with tetra-ethyl lead. Colonel Vedder pointed out in his address that the symptoms experienced in both cases were exactly those which have been long known to result from acute lead poisoning. Apparently such poisoning differs from ordinary chronic lead poisoning experienced by painters and others, because the lead is taken into the system in the form of a fat-soluble compound, which is widely distributed through the system in a very short time and causes the extreme symptoms and serious consequences noted.

Trade Notes

Charles E. Herrmann, executive vice-president of the Texas Co., died on Dec. 20 at his home in Scarsdale, N. Y.

E. E. Reifenberg & Bro. of New York, for several years one of the leading brokerage houses in the chemical industry, will discontinue business at the end of this month.

Receivers' reports of operations of the Virginia-Carolina Chemical Co. and its subsidiary, the Southern Cotton Oil Co., filed Dec. 5, were confirmed last Tuesday. Continued operation of the Virginia-Carolina business was given court sanction, in spite of the reported net loss of $104,241.57 from March 3 to Oct. 31, exclusive of the Southern Cotton Oil Co.

R. B. Robinette, chairman of the joint committee on time and place for the 1925 conventions of the three associations representing the paint and varnish industry, has announced that the Hotel Cleveland, at Cleveland, Ohio, will be headquarters for these conventions.

A deal involving $500,000 for the purchase of an arsenical iron mine, at Beaver Lake, Saskatchewan, has been closed by financial interests of Des Moines, Iowa. It is reported that numerous arsenical ore bodies in northern Canada will shortly be developed by American companies to obtain arsenic.

Gain in Fertilizer Production in 1923

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of fertilizers reported products valued at $183,088,751, an increase of 1.5 per cent as compared with 1921, the last preceding census year. The total for 1923 was made up of 7,237,164 tons of fertilizers, valued at $167,347,351, and other products, such as fish scrap, oil, grease, bone black, glue, sulphuric acid and miscellaneous chemicals to the value of $15,741,400.

Of the 573 establishments reporting for 1923, 122 were located in Georgia, 64 in North Carolina, 51 in Virginia, 48 each in Maryland and South Carolina, 38 in Alabama, 28 in Pennsylvania, 22 in Ohio, 17 each in Florida and New Jersey, 13 in Illinois, 12 in California, 11 in Indiana, 10 in Tennessee and the remaining 72 in 21 other states. In 1921 the industry was represented by 588 establishments, the decrease to 573 in 1923 being the net result of the loss of 89 establishments which had been included for 1921 and the addition of 74 new establishments. Of the 89 establishments lost to the industry, 37 were idle during the entire year, 35 had gone out of business before the beginning of 1923, 7 had been engaged primarily in the manufacture of fertilizers in 1921 but reported other commodities as their principal products in 1923 and were therefore classified in the appropriate industries, and 10 reported products valued at less than $5,000 in 1923.

The Southern District (the region lying south of the northern boundaries of North Carolina, Tennessee, Arkansas and Oklahoma and comprising, in addition to the four states named, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and Texas) reported for 1923, 320 establishments with a total production of 3,665,153 tons of fertilizers, or 50.6 per cent of the total for the industry. This percentage is comparable with 42.9 per cent for 1921, 52 per cent for 1919 and 57.4 per cent for 1914.

The statistics for 1923 and 1921 are summarized in the following table. The figures for 1923 are preliminary and subject to correction:

	1923*	1921*
Products, total value	$183,088,751	$188,246,666
Fertilizers, total, tons	7,237,164	5,994,179
value	$167,347,351	$174,878,864
Superphosphates†, tons	3,755,956	3,483,704
For sale†, tons	2,442,512	1,976,742
value	$32,934,313	$33,598,364
Made and consumed tons	1,313,444	1,506,962
Complete fertilizers, tons	3,804,324	2,985,265
value	$110,189,780	$112,786,648
Ammoniated fertilizers, tons	188,682	339,222
value	$5,647,545	$10,139,885
Commercial fertilizers (so-called) tons	245,819	209,844
value	$6,199,585	$5,207,052
Other fertilizers, tons	555,827	483,106
value	$12,376,128	$13,146,915
Fish scrap, tons	76,229	44,670
value	$2,722,688	$1,720,853
Oil, chiefly fish oil, gallons	5,918,053	2,346,632
value	$2,526,171	$677,886
Bone black, pounds	37,487,380	41,238,653
value	$1,870,948	$3,141,631
Glue, value	$787,483	$1,248,372
Grease, value	$571,903	$370,669
Sulphuric acid (basis 50° Bé.), tons	1,573,658	1,319,582
For sale, tons	242,456	175,732
value	$2,006,054	$1,871,911
Made and consumed tons	1,331,202	1,143,850
All other products‡ value	$5,256,153	$4,336,480

*The figures for 1921 include data for fertilizers to the value of $7,817,861 manufactured as subsidiary products by establishments classified in other industries and the product of 18 establishments with products valued at less than $5,000, aggregating $54,016. The figures for 1923 as given in this table relate only to the products of the fertilizer industry proper, but data for the subsidiary fertilizer products from other industries will be included in the final report.

†Includes concentrated phosphates: 1923, 16,953 tons; 1921, 18,707 tons.

‡Includes miscellaneous chemicals, pyrite, cinder, poultry and stock foods, etc.

Vanadium Corporation Absorbs U. S. Ferro Alloys Corp.

A. A. Corey, Jr., president of the Vanadium Corporation of America, announced last week that an arrangement had been effected with the U. S. Ferro Alloys Corporation for the merging of that corporation with the Vanadium Corporation.

The plan involves the taking over of the entire control of the operations and affairs of the Ferro Alloys Corporation immediately, but the corporate organization of the Ferro Alloys Corporation will be maintained and it will actively function in the continued production and sale of its products. Mr. Corey has been elected president and L. K. Diffenderfer, treasurer of the Vanadium Corporation, will be treasurer of the Ferro Alloys Corporation.

Financial

The report of Fisk Rubber Co. for the year ended Oct. 31 shows net profit of $2,736,664 after depreciation, interest, federal taxes, etc., equivalent to $14.44 a share earned on outstanding $18,951,500, 7 per cent cumulative first preferred stock, on which no dividends have been paid since May 1, 1921.

After a hearing on suit by C. H. Venner to restrain the American Hide & Leather Co. from carrying out the recapitalization plan approved by stockholders Dec. 9, Vice-Chancellor Bentley reserved decision, to give plaintiff time to submit a brief.

The profit and loss account of the Consolidated Textile Corporation and its subsidiary Consolidated Selling Co., Inc., for 9 months ended Sept. 27, shows a loss of $1,369,405 after all charges, including depreciation, amortization, etc.

Stockholders of the Commercial Solvents Corporation have ratified the plan authorizing an issue of $3,200,000 6 per cent convertible notes to finance new construction.

Latest Quotations on Industrial Stocks

	Month Ago	This Week
Air Reduction	84⅝	88
Allied Chem. & Dye	76½	83¾
Allied Chem. & Dye pfd.	117½	118
Am. Ag. Chem.	14⅝	13⅝
Am. Ag. Chem. pfd.	40¾	38
American Cyanamid	*95	*100
Am. Drug Synd.	5⅝	5⅝
Am. Linseed Co.	21¾	26
Am. Linseed pfd.	42	46
Am. Smelting & Refining Co.	84½	90¾
Am. Smelting & Refining pfd.	105	106½
Archer-Daniels Mid. Co. w.i.	24	29
Archer-Daniels Mid. Co. pfd.	89	92
Atlas Powder	49	51
Casein Co. of Am.	*68	*69
Certain-Teed Products	39	41¾
Commercial Solvents "A"	88	115½
Corn Products	38⅝	40¾
Corn Products pfd.	120	120
Davison Chem.	41½	44⅛
Dow Chem. Co	*54	*54
Du Pont de Nemours	133	136½
Du Pont de Nemours db	92	94¾
Freeport-Texas Sulphur	7¾	10
Gold Dust	39½	*40½
Grasselli Chem.	*124	*124
Grasselli Chem. pfd.	*103	*103
Hercules Powder	*88	97
Hercules Powder pfd.	*103	105
Heyden Chem.	3	2½
Int'l Ag. Chem. Co. (new)	6⅛	6⅛
Int'l Ag. Chem. pfd. (ctfs.)	*42	*52
Int'l Nickel	20	24¼
Int'l Nickel pfd.	92	*93
Int'l Salt	74	*76
Mathieson Alkali	38	54
Merck & Co.	61	60
National Lead	160	158¼
National Lead pfd.	117¼	116¼
New Jersey Zinc	181	187
Parke Davis & Co.	*80	*82
Pennsylvania Salt	*83	*84
Procter & Gamble	*110	*110
Sherwin-Williams	31½	31
Sherwin-Williams pfd.	100¾	100⅞
Tenn. Copper & Chem.	8	8½
Texas Gulf Sulphur	84½	101¾
Union Carbide	65	66
United Drug	107	116
United Dyewood	27¼	26⅛
U. S. Industrial Alcohol	84¼	83½
U. S. Industrial Alcohol pfd.	106	*107
Va.-Car. Chem. Co.	2½	2
Va.-Car. Chem. pfd.	6¾	7⅛

*Nominal. Other quotations based on last sale.

Men You Should Know About

LESLIE BROWN, of Lenox, Inc., Trenton, N. J., was elected president and chairman of the New Jersey Clay Workers Association and Eastern Section, American Ceramic Society, at the annual meeting, New Brunswick, N. J., Dec. 19.

WALTER N. CRAFTS, formerly connected with the Canadian Electric Steel Co., Ltd., has recently accepted a position as works manager of the Reading Steel Casting Co., Reading, Pa.

ARTHUR L. DAVIS, chief chemist at the Wood River Refinery of the Standard Oil Co. of Indiana, will become chief chemist of the Empire Refineries, Inc., Tulsa, Okla., Jan. 1, 1925. He will be located at Okmulgee, Okla., in charge of control and development work in the plant there and other refineries located at Cushing, Okla., Ponca City, Okla., and Gainesville, Tex. Mr. Davis has been the national secretary-treasurer of the Alpha Chi Sigma fraternity for the past 2½ years and will continue in the same capacity, moving the office from its present location in Alton to Okmulgee, Okla.

WILLIAM N. DAVIS, an official of Foster & Davis, Inc., Bartlesville, Okla., has been re-elected president of the Mid-Continent Oil & Gas Association for the ensuing year, making his fifth term in that office. HARRY H. SMITH, of Tulsa, has been re-elected secretary and treasurer.

Dr. EDWARD C. ELLIOTT, president of Purdue University, West Lafayette, Ind., gave an address dealing with the practical benefits of the state's research institutions, before the members of the Kiwanis Club, Indianapolis, at the Claypool Hotel in that city, Dec. 10.

General AMOS A. FRIES, chief of the Chemical Warfare Service, United States Army, gave an illustrated lecture before a joint session of the Western New York Sections of the American Chemical Society and the American Electrochemical Society at the Chamber of Commerce Building, Niagara Falls, N. Y., Dec. 16.

FRANK GALLO, chemist, of Union Hill, N. J., was severely injured in an explosion which occurred in his laboratory on Franklin St., Dec. 14, and since that time has been at the North Hudson Hospital.

W. C. GRAHAM, director of research, Gilchrist & Co., Chicago, Ill., sugar apparatus, has been visiting a number of producing districts in Louisiana on a tour of inspection and investigation.

W. L. KISTLER has resigned as president of the Producers & Refiners Corporation, Denver, Colo., effective Dec. 15. He has been ill at his home at Tulsa, Okla., for some time past.

CHARLES F. MARTIN has been elected president of the Marland Oil Co., Ponca City, Okla. He was formerly connected with Francoma Oil Co., Tulsa, Okla.

M. McFARLAND, of the Charcoal Iron Co., Escanaba, Mich., has been engaged by the White Marble Lime Co., of the same city, to supervise production at its plant.

R. H. McKEE, of Columbia University, has returned from abroad.

E. V. PETERS, of the New Jersey Zinc Co., New York, and president of the National Paint, Oil & Varnish Association, has returned from a trip abroad. He attended the annual convention of the Federation of Associated Paint, Color & Varnish Manufacturers, recently held in London, England.

WILLIAM H. PIERCE, vice-president of the American Smelting & Refining Co. and president of the Baltimore Copper Smelting & Rolling Co., Baltimore, Md., was injured in an automobile accident on Dec. 13 and has since been at the Mercy Hospital in that city. He is reported to be much improved.

FRANCIS C. PRATT, vice-president in charge of engineering of the General Electric Co., has been appointed to fill the vacancy caused by the resignation of G. E. Emmons as vice-president in charge of manufacturing and chairman of the manufacturing committee. Mr. Pratt's new title will be vice-president in charge of engineering and manufacturing.

JOHN F. PUTNAM has become general manager of the National Silica Co., Chicago, Ill., with works at Oregon, Ill., succeeding William Stevenson, deceased.

Dr. CHARLES L. REESE, director of E. I. du Pont de Nemours & Co., Wilmington, Del., and formerly head of the chemical division of that organization, has been elected president of the Johns Hopkins Alumni Association of the Wilmington district. Dr. HAMILTON BRADSHAW, assistant chemical director of the du Pont company, has been appointed a member of a special executive committee to assist Dr. Reese in perfecting the local organization.

FRED M. SACKET, vice-president of the Louisville Cement Co., Louisville, Ky., was recently elected United States Senator from Kentucky on the Republican ticket.

R. NORRIS SHREVE, chairman of the Dye Division of the American Chemical Society, addressed the graduate students in chemical engineering at Columbia University, Dec. 18, speaking on the subject of the manufacture of beta-naphthol.

Colonel E. B. VEDDER addressed a joint meeting of the Chemical Society of Washington, Washington Academy of Sciences, Baltimore Section of the American Chemical Society and Medical Society of the District of Columbia on Thursday, Dec. 11, speaking on the subject, "The Toxicity of Lead Tetraethyl and Other Substances."

Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Smithsonian Institution, Washington, D. C., Dec. 29 to Jan. 3.

AMERICAN CERAMIC SOCIETY, annual meeting, Columbus, Ohio, Feb. 16 to 21.

AMERICAN CHEMICAL SOCIETY, New York Section, Jan. 9.

AMERICAN ELECTROCHEMICAL SOCIETY, Niagara Falls, April 23 to 25.

AMERICAN PULP AND PAPER MILL SUPERINTENDENTS ASSOCIATION, Niagara Falls, N. Y., June 4 to 6.

AMERICAN MANAGEMENT ASSOCIATION, annual convention, Hotel Astor, New York, Jan. 28, 29 and 30.

AMERICAN SOCIETY FOR TESTING MATERIALS, twenty-eighth annual meeting, Atlantic City, N. J., June 22 to 26.

BRUSSELS INTERNATIONAL AND COMMERCIAL FAIR (sixth), Brussels, Belgium, March 25 to April 8.

CANADIAN NATIONAL CLAY PRODUCTS ASSOCIATION, twenty-third annual convention, Prince George Hotel, Toronto, Canada, Jan. 20 to 22.

CANADIAN PULP AND PAPER ASSOCIATION, Montreal, Jan. 28 to 30.

COMPRESSED GAS MANUFACTURERS ASSOCIATION, twelfth annual meeting, Hotel Astor, New York, Jan. 26.

SOUTHERN EXPOSITION, Grand Central Palace, New York, May 11 to 23.

Obituary

WILLIAM O. ALLISON, founder and publisher of the *Oil, Paint & Drug Reporter*, died at his home in New York on Dec. 18. Mr. Allison entered the publishing business at an early age and was but 22 years old when he began publishing the *Reporter*. Later he established the *Painters Magazine* and purchased the *Druggists Circular*, which publications are still prominent in their respective fields. Funeral services were conducted at Englewood Cliffs, N. J., with interment at Englewood.

WILLIAM Y. BOGLE, SR., of Montclair, N. J., president of the American Brick Corporation, New York, died suddenly on Dec. 15 from a heart attack at the Hotel Montclair, where he resided. He was 70 years of age. He had lived in Montclair for 56 years, and was prominent in civic and banking circles in the city. He is survived by his wife, a son and two daughters.

WIRT CORNWELL, of Ann Arbor, Mich., well-known paper manufacturer, died recently at his home in that city, aged 74 years. He was of the second generation of the prominent papermaking family of that name.

Dr. HOWARD B. FELTON, of Philadelphia, Pa., an official of the Felton-Sibley Co., of that city, manufacturer of paints and varnishes, died at his local residence on Dec. 7, as a result of a paralytic stroke.

HORACE L. WELLS, emeritus professor of chemistry at Yale University, died on Dec. 19 after a short illness. He retired from active duties in June, 1923.

Market Conditions

Prices for Chemicals Hold Steady Under Quiet Demand

Only Light Volume of New Business Reached Market Last Week—Steady Undertone to Values

THE usual slowing up spot trading which characterizes the holiday season was in evidence last week and the majority of reports agreed that new business was light. There also has been a seasonal slowing up in call for contract deliveries, as some of the consuming industries will take inventory and are deferring deliveries on that account. However, there is a widespread belief that the coming year will account for a large consumption of chemicals and allied products. This is predicated on the generally improved position of industry and is substantiated by the large contracting movement of the past 2 or 3 months.

The weighted index number for the week was 160.09 as compared with 160.23 a week ago. A lowering in price for linseed oil was mainly responsible for the change in the index. Chemicals, as a whole, are holding firm in price. The alkalis appear to be well entrenched at present levels. Some of the acids are tending toward higher levels and the low price levels reached by many miscellaneous chemicals would make recoveries more probable than any further declines. All the metal salts are firmly held as a result of the upward swing in the metal markets and the latter does not yet seem to have run its course, as further advances were recorded last week.

One of the disappointing spots in the present market is found in the sale of calcium arsenate and its reflex action on the movement of arsenic. The use of arsenate to control weevil damage in the cotton-growing states gave an impetus to arsenic production in the past 2 years but uncertainty regarding the amount of arsenate to be used this coming season has placed the market in an unsettled position from which it can hardly recover until more definite information is available regarding consumptive requirements. Weather reports say that the temperature in some parts of northwest Texas was below zero last week and cold weather over a good part of the cotton belt is regarded as a check on the growth of the boll weevil.

Acids

Reports of firm markets at primary points abroad together with reduced stocks of imported tartaric in the spot market have placed values on a higher plane and the inside quotation is given as 27c. per lb. Some orders are said to have been taken for delivery over the first quarter of next year. Interest in citric acid has not broadened to any appreciable extent but values are well sustained with spot quotations pretty much in line with replacement values. Acetic acid has been moving freely of late but new business last week was not important and there was no change in the schedule of selling prices. Lactic acid is in a firm position with no competition among sellers

Arsenic Easy Under Slow Demand—Tartaric Acid Firmer—Acetone Under Selling Pressure—Small Supply of Calcined Carbonate of Potash—Fluoride of Soda Steady—Bichromate of Soda Unsettled—Oxalic Acid Firmer—Crude Glycerine Higher

and with consumption reported to be taking up the bulk of production. Formic acid, on the other hand, is weak in price and sales are being made at private terms with prices heard as low as 10½c. per lb. The increase in demand for sulphuric acid has taxed the output of some producers, especially in the South, and there are reports of some producers calling on outside plants to take care of overflow orders. There is no scarcity of supply, however, and prices are holding at recently quoted levels.

Potashes

Bichromate of Potash—The market lacked activity and consumers appeared to be covered for current needs. Interest in future deliveries also was slight and quiet conditions are expected to prevail for the next week or longer. The prices quoted by first hands were maintained at 8¼@8½c. per lb.

Carbonate of Potash—The stringency in spot supplies of calcined carbonate served to sustain interest in this market, but trading necessarily was limited. In view of the scarcity a reliable price cannot be quoted for spot offerings of 80-85 per cent but shipments from foreign ports were quoted at 6c. per lb. Spot holdings of 96-98 per cent were available at 6@6½c. per lb. Hydrated carbonate offers a contrast to the calcined, as stocks of the former are ample and demand is limited. Asking prices for 80-85 per cent range from 5c. to 5¼c. per lb.

Caustic Potash—While there were reports that prompt shipment from abroad could be bought at 7⅛c. per lb., the majority of sellers were asking 7¼c. per lb. Goods held in store in the local market were offered at 7¼c. to 7½c. per lb., according to seller and quantity. The domestic maker announced no change in price and continued to quote round lots at 7⅛c. per lb., f.o.b. works.

Prussiate of Potash—Holders of red prussiate were reported to be more eager to dispose of stocks, and quotations were heard as low as 36c. per lb. Yellow prussiate shows a range according to seller with spot prices at 16½@16¾c. per lb. and shipments from foreign producing points at 16¼@16½c. per lb. Demand has been confined to relatively small lots.

Sodas

Soda Ash — Shipments against contracts are of seasonal volume with some slowing up in the movement as compared with that for last month. New business last week was not heavy but producers are carrying a large volume of orders for delivery over next year. Values are on a steady basis both for contracts and for jobbing account. The contract price for light ash in carload lots at works is $1.25 per 100 lb. in bulk, $1.38 per 100 lb. in bags, and $1.63 per 100 lb. in bbl. Dense ash is offered on contract at $1.35 per 100 lb. in bulk, $1.45 per 100 lb. in bags, and $1.74 per 100 bl. in bbl.

Acetate of Soda — Production has been on a scale large enough to provide ample supplies, and some producers are reported to have been willing to shade the quoted price of 5c. per lb. for carload lots, f.o.b. works. The open quotation, however, is kept at the 5c. per lb. level and smaller lots are held at a premium.

Bichromate of Soda—A rather wide range in prices has been heard in this market and some small lot orders have been placed as high as 6¾c. per lb. In some quarters the latter figure has been maintained and the fact that buyers have been willing to pay that price is regarded as proof that small lot offerings at lower prices have not been general. It is equally certain, however, that sales have been made at lower levels and trading levels appear to be matter of negotiation. On carlot business 6¼@6½c. per lb. is fairly representative of the market.

Caustic Soda — Some producers are reported to have only small stocks at works, and deliveries have continued with regularity so that surplus stocks are regarded as unusually low. Inquiries for next year delivery were in

the market in the past week and a large consumption is indicated for 1925. Jobbing demand was light but is expected to revive after the turn of the year. Values for export appear to be firmer with prices ranging from $2.90 to $3.10 per 100 lb., f.a.s. Quotations for domestic sales are repeated at former levels.

Fluoride of Soda—The foreign material is firmly held with cables quoting 9c. per lb. for forward positions. Spot fluoride also is quoted at 9c. per lb. but higher prices are predicted based on the strength in foreign markets.

Nitrate of Soda — Recent arrivals have insured a plentiful supply of nitrate but buying was inactive last week, and there is nothing of significance in recent developments. The position of sterling has aided in stabilizing values and factors in the selling side of the market are holding spot nitrate at $2.47½c. per 100 lb., with January shipments at $2.52 per 100 lb. and an upward sliding scale for the more distant positions.

Prussiate of Soda—Holdings of prussiate in the spot market are not oppressive and values have shown a tendency to harden. Inquiry is running to small lots with asking prices at 9⅜@9½c. per lb. On round lots 9¼c. per lb. is asked. Shipments of foreign made prussiate are held at 9⅛@9¼c. per lb.

Miscellaneous Chemicals

Acetone—The easy tone which has been in evidence in recent weeks still prevails and buyers find no difficulty in securing some grades of this chemical at 14c. per lb. in carload lots. Other producers are not willing to meet this figure and are asking up to 16c. per lb.

Arsenic—This material has failed to arouse much interest on the part of buyers and speculative trading which was a factor a year ago has disappeared. While a fairly normal consumption may be expected in some lines, the large outlet expected through the manufacture of calcium arsenate is shrouded in doubt. With large stocks of the latter held by producers, there is little incentive to take on arsenic stocks and this situation may be expected to continue for some time. In the meantime prices for arsenic range from 6c. per lb. to 6½c. per lb., depending on grade and seller.

Bleaching Powder—Fair inquiry was reported for liquid chlorine in the first part of the week but bleaching powder was quiet. Offerings of the latter are plentiful and contract business has not been heavy enough to keep producing plants at anything like capacity operations. The market, however, is not under pressure and there have been no reports of price concessions. The contract price for bleaching powder in large drums, carlots, at works, is $1.90 per 100 lb. and liquid chlorine on contract is offered at 4c. per lb. in tanks, f.o.b. works.

Carbon Tetrachloride—Conditions in this market have been more favorable to sellers. Surplus stocks have been worked off and increased consumption has eliminated selling competition and steadied values. Current prices are on a basis of 6¾@7c. per lb., with the range depending on quantity.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	160.09
Last week	160.23
Dec., 1923	165.00
Dec., 1922	164.00
Dec., 1921	145.00
Dec., 1920	189.00
Dec., 1919	245.00
Dec., 1918	277.00

Heavy chemicals ruled steady to firm, but a moderate decline in linseed oil was reflected in the weighted 'ndex number, which settled at 160.09, a reduction of 14 points.

Formaldehyde—There was no special feature to trading last week. Buying was not active but this had no bearing on asking prices and carlots are reported to be firm at 9c. per lb. with higher prices paid for smaller amounts.

Glaubers Salt — Recent buying has been of fair volume but offerings of imported grades were plentiful and sellers were willing to meet buyers' views in order to move stocks. Sales were reported at 80c. per 100 lb. and asking prices ranged from that figure up to 90c. per 100 lb. Sellers of domestic grades were holding at $1.25 per 100 lb. and upward.

Alcohol

Producers reported trade as satisfactory, most of the call for denatured coming from the automobile field. There was little or no change in the raw materials situation and the undertone of the market for the denatured product was firm in all directions. Spot stocks were barely sufficient to meet the demand. Completely denatured, formula No. 5, 188 proof, was quotably unchanged at 55c. per gal. in drums, carload basis.

Butanol production is well taken care of by existing contracts, and nominally the market held at 27c. per lb., in drums. A shipment arrived from abroad.

Methanol was quiet and prices were barely steady. Producers quoted 74c. per lb. on the pure, tanks, works. On the 97 per cent grade the market held at 72c. per gal., in drums, carload lots.

Coal-Tar Products

Regular Contract Shipments Sustain Market for Crudes—Phenol Offered More Freely—Aniline Oil Firm

FROM the standpoint of new business placed the market for coal-tar products was a quiet affair and no important price changes were reported. In the division for crudes the undertone was steady to firm. There has been some gain in actual production, but regular contract deliveries have absorbed the bulk of the offerings. In benzene producers report moderate stocks, the holdings being reduced by the constant call for the motor fuel grades. Domestic production of sulphate of ammonia and creosote oils is virtually sold up, leaving prices in a more or less nominal position. Foreign markets for creosote have strengthened on prospects of renewed buying on the part of American consumers. The cresylic acid situation remains unsatisfactory, traders complaining of sharp competition. Phenol supplies for nearby delivery have increased in some quarters and this has eased prices a little. Aniline oil was in good request and firm selling views were entertained by leading producers. Paranitraniline and H-acid were offered rather freely at former prices. Pyridine was unsettled on slow buying.

Benzene—Offerings of benzene for immediate delivery were small and prices held on a comparatively steady basis. Production continues to gain, but rather slowly, and first hands say that coke-oven operations will have to increase to a much greater extent before stocks become burdensome. Demands from the motor fuel field have not suffered because of cheap gasoline. Export trade has been restricted, due to the active and more remunerative home market. Closing prices were unchanged, the 90 per cent grade selling at 23c. per gal., and the pure at 25c. per gal., tank car basis, works.

Creosote—On more buying interest from America foreign markets for creosote oil have strengthened. Manchester, England, reported sellers at 5¾@6d. per gal., works, some sellers holding out for the top figure.

Cresylic Acid—Trading slow and competition keen, causing prices to ease somewhat on desirable business. On the 97 per cent grade there were sellers at 59@63c. per gal., carload basis.

Naphthalene — The market was a quiet affair, but most sellers did not care to trade except at full quotations. Buyers did not evince much interest in futures. First hands asked 5½c. per lb. on white flake for 1925 delivery. Ball naphthalene was held at the usual premium over flake. Chipped material was quiet and more or less nominal at 4½c. per lb.

Paranitraniline — Several sellers appeared anxious for business and this resulted in an unsettled market so far as prices were concerned. Quotations named ranged from 65@70c. per lb.

Phenol—Prices were easier in some quarters, offerings appearing on the market at 23@24c. per lb., in drums. On contract it was intimated that 22c. might be done on round lots. Demand has been less active.

Pyridine—Quiet prevailed in the local market and prices were barely steady. Offerings from abroad have been more numerous. Spot material was available at $3.75@$4.10 per gal., according to seller.

Solvent Naphtha—Demand slow, but production restricted and prices generally steady. Water-white, prompt shipment from works, 24c. per gal., tank car basis.

Vegetable Oils and Fats

Cottonseed Oil Unsettled—Linseed Oil Steady on Strength in Seed—Coconut Oil Advances—Tallow and Greases Higher

WITH the exception of cottonseed oil the market for vegetable oils ruled firm, notwithstanding the routine nature of business. Operators in coconut oil became excited on receipt of news to the effect that a mill located at Portland, Ore., was badly damaged by fire, and prices toward the close were strong and wholly nominal. Cottonseed oil eased off on profit taking. Linseed oil was inactive, but firm seed markets caused prices to hold on a steady basis. Firm prices also obtained for palm oils, olive oil foots and crude corn oil. Tallow again sold at higher prices.

Cottonseed Oil—Consuming demand for refined oil was inactive and, with speculative commodity markets generally unsettled, a slightly easier undertone featured the market. Profit taking was in evidence in the options and final prices were unchanged to 20 points net lower. December oil settled around 1.50c. bid, with January at 11.41c. bid, and May at 11.94c. bid, in bbl., New York terms. Crude oil sold at 9¾c. per lb. in Texas, and 10c. per lb. Southeast and Valley, tank car basis, f.o.b. mills. Later bids for crude were reduced ⅛c. per lb., with rumors of business in Texas at 9⅝c. per lb. The November statistics attracted much attention. The disappearance of refined oil was good, amounting to 281,000 bbl., but most traders expected an even better showing for November. The disappearance in October reached 328,000 bbl., and in November a year ago 216,000 bbl. were disposed of. Stocks of refined oil on Nov. 30, taking into consideration holdings of seed and crude oil, amounted to 1,413,000 bbl., which compares with 956,000 bbl. a month ago and 1,126,000 bbl. a year ago. Exports of crude and refined cottonseed oil for the 4 months ended Nov. 30 amounted to 13,769,759 lb., which compares with 12,336,700 lb. for the same period a year ago. Export trade has fallen off since the recent advance in prices. To dispose of this season's production of oil, consumption will have to be maintained at 250,000 bbl. monthly for the remainder of the season. Lard compound was quiet, but quotably unchanged at 13¾@14c. per lb. Pure lard in Chicago held at a premium of approximately 5c. per lb. over oil.

Linseed Oil—With the Northwestern seed markets holding around the $3 per bu. basis, the position of linseed oil underwent little change in the past week. Trading was inactive, but few crushers were willing to force sales, either for nearby or future delivery oil. The forward positions in the world's seed markets commanded a premium, and this was taken as an indication that the seed situation was not a favorable one for consumers. Interest centered in the Argentine crop developments and the past week brought out nothing of an encouraging nature. Inquiry for Argentine seed has improved, and this supported prices. Most crushers believe that the Argentine exportable surplus from this crop will amount to somewhere between 36,000,000 and 40,000,000 bu. On the other hand, the Argentine official estimate, which dates back more than a month, placed the exportable at 46,500,000 bu. Actual exports from the 1923-24 crop from Jan. 1 to Dec. 19 amounted to 57,415,000 bu. Receipts of domestic seed at the Northwestern terminals from Sept. 1 to date amounted to 24,000,000 bu. Linseed oil for immediate and nearby delivery settled at $1.13 per gal., in bbl., carload basis, with March-April at $1.14 and May-June at $1.17.

China Wood Oil—Reports from China indicated that prices were strong, with moderate inquiry from America. Trading here was not active, but the market held at 15¾@16c. per lb. for oil in cooperage, immediate delivery. On the Pacific coast 14c. was asked for oil in tank cars, nearby positions.

Cottonseed Oil Production Gains in November

Cottonseed crushed in the four months ended Nov. 30 totaled 1,853,456 tons, compared with 1,567,672 tons in the corresponding period a year ago. November consumption of refined oil, based on the Census Bureau's figures, amounted to 281,000 bbl., against 328,000 bbl. in October. Cottonseed statistics for the first 4 months of the season follow:

	Aug. 1 to Nov. 30 1924	Aug. 1 to Nov. 30 1923
Seed received, ton	3,023,385	2,359,000
Seed crushed, ton	1,853,456	1,567,672
Crude oil mfd., lb.	551,378,263	459,998,884
Ref'd oil mfd., lb.	403,227,931	288,285,683
Stocks, Nov. 30:		
Seed, ton	1,184,803	803,947
Crude oil, lb	106,795,401	140,657,576
Refined oil, lb	140,114,657	98,131,160
Exports, 4 months:		
Crude oil, lb	3,035,365	7,259,114
Refined oil, lb	10,734,394	5,077,586
Cake and meal, ton	166,119	50,511

Corn Oil — Orders of crude were placed at 10⅝c. per lb., tank cars, f.o.b. Chicago, December delivery.

Coconut Oil—Prices advanced in all quarters on news of a fire at the Portland, Ore., coconut oil mill. On the Pacific coast prompt oil was raised to 10¼c. per lb., with February-March nominal at 10@10¼c., tank car basis. April forward was nominal at 9¾@10c. per lb. In New York spot and nearby Ceylon type oil settled at 10½@10¾c. per lb.

Olive Oil Foots—Offerings were light and prices firm at the recent advance to 9¾@10c. per lb. Consuming demand has improved, especially from the textile field.

Palm Oils—With an even higher market for tallow the ideas of sellers of palm oils were quite firm. Lagos oil for nearby delivery closed at 9⅞@10c. per lb., with futures nominal at 9⅝c. per lb. Niger for nearby delivery settled at 8¾@8⅞c. per lb.

Soya Bean Oil—Scattered lots were offered for nearby shipment from the Pacific coast at 11⅝c. per lb., tank cars, duty paid. For bulk oil for future shipment from the Orient the market was nominally unchanged at 8.25c. per lb., in bond, c.i.f. Pacific coast ports.

Tallow, etc.—Business was placed in city extra tallow at 10¾c. per lb., loose, f.o.b. melters' plants, an advance of ¼c. for the week. Yellow grease was advanced to 9⅜@9¾c. per lb., in sympathy with tallow. Oleo stearine was a shade firmer, traders asking 12c. per lb., carload basis.

Miscellaneous Materials

Antimony—Oriental markets were firmer and this brought out a higher trading level here. Chinese antimony on spot was raised to 15c. per lb. Chinese needle, lump, unchanged at 10@10½c. per lb. Standard needle, powdered, 200 mesh, 11½c. per lb. White oxide firm at 13@14c. per lb., basis 99 per cent.

Blanc Fixe—Trading quiet so far as new business was concerned. Contract deliveries up to normal and prices steady at 3½@3¾c. per lb. for the dry, in bbl., carload lots.

Carbon Gas Black—Production of carbon gas black in 1923, according to the Bureau of the Census, amounted to 138,300,000 lb., valued at $11,692,000. Production in 1922 was placed at 67,800,000 lb. and in 1921 at 59,800,000 lb. The market in the past week was quotably unchanged at 6@8c. per lb., in bags, contracts, works. Demand has improved, but competition among sellers remains keen.

Glycerine—Higher prices prevailed for dynamite and crude, demand being in evidence on a larger scale. Dynamite sold at 18½c. per lb. and later was raised to 18¾c. per lb. asked, f.o.b. Middle West. Soap lye crude, basis 80 per cent, advanced to 12½c. per lb., loose, f.o.b. point of production. Chemically pure in the New York market was firm at 19@19½c. per lb., in drums, carloads.

Naval Stores—Offerings at Southern points were smaller and prices hardened. Spirits of turpentine advanced to 85@85½c. per gal. Inquiry improved, paint manufacturers showing more interest in the situation. Rosins also moved into a firmer position, the lower grades settling at $7.60@$7.70 per bbl.

White Lead—Another advance was reported in the metal, leading interests establishing the market for pig lead at 9½c. per lb., which compares with 9.35c. per lb. a week ago. The advance naturally strengthened the position of pigments, but corroders did not alter the selling basis. Demand for white lead was up to the average for this time of the year. Carbonate of lead, in bbl., carlots, held at 11c. per lb., with the basic sulphate at 10½c. and supersublimed at 11c. Litharge was offered at 12¼c., red lead at 12¾c. and orange mineral at 15¾c. per lb.

Zinc Oxide—Higher prices for ore and metal did not affect the market for zinc oxide. There has been a fair consuming demand, but competition for business continues keen. Lead free oxide, American process, 7⅞c. per lb., in bags, round lot basis.

Imports at the Port of New York

December 19 to December 24

ACIDS—Citric—150 kegs, Genoa, Superfos Co.; **Cresylic**—24 dr., Barrow, American-Hawaiian S.S. Co.; 1 pkg., Barrow, Sherlow Chemical Co. **Formic**—84 carboys, Rotterdam, R. W. Greeff & Co. **Oxalic**—50 bbl., Rotterdam, Innis, Speiden & Co.; 40 csk., Antwerp, Pacific Chemical Co. **Phosphoric**—4 carboys, London, F. B. Vandegrift & Co. **Stearic**—20 cs., Rotterdam, M. W. Parsons & Plymouth Org. Lab.

ALCOHOL—400 bbl., Arecibo, C. Estevas,; 60 bbl., San Juan, Olivett Dist. Co.; 103 csk. butyl, Rotterdam, H. A. Metz & Co.

ALBUMEN—20 bbl., Trieste, Pfaltz & Bauer.

ALUMINUM SULPHATE—115 csk., Marseilles, Seaboard National Bank.

AMMONIUM CARBONATE—10 bbl., Liverpool, Brown Bros. & Co.

AMMONIUM BICARBONATE—78 csk., Rotterdam, Kuttroff, Pickhardt & Co.

ANTIMONY REGULUS—50 cs., London, Order.

ANTIMONY SULPHURET—7 csk, London, Order; 49 csk, Havre, American Express Co.

BARIUM SUPEROXIDE—30 kgs., Rotterdam, Mallinckrodt Chemical Works.

BARYTES—1 lot in bulk, Rotterdam, Ore & Chemicals Corp.

BAUXITE—190 bg., Paramaribo, E. B. Fairweather; 1 lot in bulk, Naples, Order.

BROMIDES—30 cs., Rotterdam, Kachurin Drug Co.

CALCIUM CHLORIDE—154 dr., Rotterdam, Coal & Iron National Bank; 214 csk., Rotterdam, American Exchange National Bank.

CALCIUM CITRATE—163 csk., Messina, Order.

CAMPHOR—4 csk., Hamburg, Order.

CHALK—1,000 bg., Antwerp, Brown Bros. & Co.; 700 bg., Antwerp, National City Bank; 250 bg. and 167 bbl., Antwerp, Order; 250 bg., Antwerp, Order; 500 tons, London, Taintor Trading Co.; 3,350 tons (in bulk), Calais, Taintor Trading Co.

CHEMICALS—6 cs., Antwerp, C. B. Richard & Co.; 140 bg., arabic, Antwerp, Order; 210 csk., Rotterdam, Roessler & Hasslacher Chemical Corp.; 20 csk, Rotterdam, Kidder, Peabody & Co.; 152 csk., Rotterdam, Roessler & Hasslacher Chem. Co.; 22 bbl., Bremen, Order; 54 bbl., Rotterdam, Chaplain & Bibbo; 90 csk., Rotterdam, Roessler & Hasslacher Chem. Co.; 100 csk. and 35 cs., Rotterdam, Order; 303 pkg., Rotterdam, A. Klipstein & Co.

COAL-TAR INTERMEDIATES—13 csk., Rotterdam, Ciba Co.

COLORS—5 csk. paste, Liverpool, Irving Bank-Col. Trust Co.; 10 cs. bronze, Hamburg, T. Riessner; 6 pkg. aniline, Antwerp, Bernard, Bernard, Inc.; 79 pkg. aniline, Rotterdam, Kuttroff, Pickhardt & Co.; 36 csk. do., Rotterdam, H. A. Metz & Co.; 16 csk., Havre, S. L. Libby & Co.; 5 cs. aniline, Genoa, Bernard, Bernard, Inc.; 21 pkg. aniline, Havre, Ciba Co.; 2 cs. do., Havre, Irving Bank-Col. Trust Co.; 400 cs. bronze, Bremen, Baer Bros.; 19 cs. do., Bremen, Gerstendorfer Bros.; 219 csk. aniline, Rotterdam, Grasselli Dyestuff Corp.; 2 csk., Rotterdam, Kutroff, Pickhardt & Co.; 38 csk. earth, Bremen, Fezandie & Sperrle.

COPPER SULPHATE—95 bbl., Genoa, Order.

CORUNDUM ORE—85 bg., Beira, Order; 2,246 bg., Delagoa Bay, Standard Bank of South Africa; 342 bg., Durban, Order.

CREOSOTE—40 dr., Barrow, American-Hawaiian S.S. Co.

COPPER SULPHATE—95 bbl., Genoa, Order.

CORUNDUM ORE—85 bg., Beira, Order; 2,246 bg., Delagoa Bay, Standard Bank of South Africa; 342 bg., Durban, Order.

CREOSOTE—40 dr., Barrow, American-Hawaiian S.S. Co.

DEGRAS—50 bbl., Manchester, Order; 30 bbl., Bremen, National City Bank.

FUSEL OIL—18 dr., Rotterdam, Order; 31 dr., Venice, Order; 2 dr., Valencia, Order.

GALLNUTS—400 bg., Shanghai, Order.

GAMBIER—2,211 cs., Singapore, Order; 316 bg., Singapore, Order.

GLYCERINE—42 dr. crude, Antwerp, Marx & Rawolle; 100 dr. crude, Antwerp, Core & Herbert.

GUMS—56 bg. copal, Antwerp, S. Winterbourne & Co.; 41 bg. tragacanth, London, Bank of Montreal; 510 bg. copal, Matadi, Niger Co.; 1,400 bg. copal, Antwerp, Order; 132 bg. copal, Antwerp, W. Scheel; 210 bg. copal and 50 cs. damar, Singapore, L. C. Gillespie & Sons; 100 cs. damar, Singapore, Kidder, Peabody Accept. Corp.; 105 cs. damar, Singapore, Standard Bank of South Africa; 105 bg. damar, Singapore, W. Brandt's Sons & Co.; 400 pkg. damar, Singapore, Baring Bros. & Co.; 200 cs. damar, Singapore, Order; 128 cs. copal, Singapore, Order; 100 cs. copal, Singapore, Baring Bros. & Co.; 64 bg. copal, Singapore, Order; 470 bg. yacca, Port Adelaide, Baring Bros. & Co.; 277 cs. kauri, Auckland, Guaranty Trust Co.; 74 cs. do., Auckland, Chemical National Bank; 470 cs. do., Auckland, Chase National Bank; 1010 cs. do., Auckland, Order; 40 cs. copal, Antwerp, Order.

IRON OXIDE—10 csk, Liverpool, Stanley Doggett, Inc.; 8 csk., Liverpool, C. B. Chrystal Co.; 11 csk., Liverpool, Reichard-Coulston, Inc.; 12 csk., Liverpool, Order; 1,500 bbl., Malaga, Order; 18 csk., Manchester, Order.

IRON POWDER—7 cs., Bremen, Mallinckrodt Chemical Works.

LITHOPONE—600 csk., Antwerp, B. Moore & Co.; 320 csk., Rotterdam, Brown & Raese.

LOGWOOD—1 lot and 12,056 kilos, St. Marc, Stamford Dyewood Co.

MAGNESITE—313 bg., Rotterdam, Speiden, Whitfield Co.

MAGNESIUM CHLORIDE—368 dr., Hamburg, Innis, Speiden Co.

OILS—China wood—450 tons, Shanghai, Spencer Kellogg & Sons; 145 tons, Shanghai; G. W. S. Patterson & Co.; 220 tons, Shanghai; Order. **Palm**—209 csk and 90 bbl., Liverpool, Guaranty Trust Co.; 238 dr., Antwerp, Order; 3,340 dr., **Matadi**, Niger Co.

OILSEEDS—Castor—1,693 bg., Pernambuco, Baker Castor Oil Co.; 2,310 bg., Pernambuco, Order; 2,000 bg., Santos, Central Union Trust Co.; 6,000 bg., Santos, Order.

PITCH—104 csk., Manchester, A. Hurst & Co.

PLUMBAGO—290 bbl., Colombo, Order.

POTASSIUM SALTS—18 kegs prussiate, Liverpool, C. Tennant Sons & Co.; 1 lot manure salt (in bulk), Hamburg, Potash Importing Corp. of America; 5,000 bg. muriate, Antwerp, Societ Comm. des Potasses d'Alsace, 2 lots manure salt, Bremen, Potash Importing Corp. of America.

PYRIDINE—5 dr., Rotterdam, American Hawaiian.

QUEBRACHO—10 bg., Buenos Aires, H. K. Mulford & Co.; 1,000 bg., Buenos Aires, Goldman, Sachs & Co.; 4,011 bg., Buenos Aires, Order.

QUICKSILVER—200 flasks, Leghorn, Leghorn Trading Co.; 200 flasks, Leghorn, Order.

SAL AMMONIAC—100 csk., Rotterdam, Kuttroff, Pickhardt & Co.; 13 csk., Rotterdam, E. Suter & Co.

SHELLAC—25 bg., Hamburg, Ralli Bros.; 16 cs. Rotterdam, C. F. Gerlach; 104 cs., Singapore, National Park Bank; 122 bg., Calcutta, First National Bank, Boston; 450 bg., Calcutta, Brown Bros. & Co.; 100 bg., Calcutta, Bank of N. Y. & Trust Co.; 200 bg., Calcutta, Order; 44 pkg., Calcutta, Marx & Rawolle; 476 pkg., Calcutta, Anglo So. Am. Trust Co.; 700 bg., Calcutta, Order.

SODIUM SALTS—22 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 56 csk. prussiate, Rotterdam, Meteor Products Co.; 13 cs. cyanide, Havre, C. Hardy, Inc.; 63 csk. phosphate, Antwerp, Roessler & Hasslacher Chemical Co.

SIERRA—450 bg., Leghorn, Reichard-Coulston, Inc.

STRONTIUM NITRATE—304 csk., Rotterdam, Meteor Products Co.

SUMAC—140 bg. ground, Palermo, J. S. Young Co.; 840 bg. do., Palermo, Order.

TALC—200 bg. Marseilles, Whittaker, Clark & Daniels; 400 bg., Marseilles, Moore, & Munger; 900 bg., Marseilles, L. A. Salomon & Bro.

TARTAR—100 pkg., Naples, C. B. Richard & Co.; 988 bg., Oran, Tartar Chemical Works; 317 bg., Oran, C. Pfizer & Co.; 44 csk., Naples, Tartar Chemical Works; 549 bg., Tarragona, Harshaw, Fuller & Goodwin; 202 bg., Buenos Aires, C. Pfizer & Co.

WATTLE BARK—1,936 bg., Durban, I. R. Boody & Co., 441 bg., Durban, Standard Bank of South Africa; 3,921 bg., Durban, Tannin Corp.

WAXES—100 bg. beeswax, Liverpool, Order; 228 bg. beeswax, Antwerp, Strohmeyer & Arpe; 18 cs. ozokerite, Trieste, Order; 40 cs. beeswax, Havre, Chemical National Bank; 47 bg. carnauba, Pernambuco, W. R. Grace & Co.

WHITING—500 bg. Havre, L. A. Salomon & Bro.; 2,540 bg., Havre, S. L. Libby & Co.

WOOL GREASE—30 csk., Hamburg, Alpers & Mott.

ZINC CHLORIDE—37 dr., Rotterdam, Order.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS for the ceramic industry. Rio de Janeiro, Brazil. Agency.—12,728.

NAVAL STORES and chemicals. Coblenz, Germany. Purchaser.—12,809.

CHEMICALS, industrial. Bordeaux, France. Purchase.—12,730.

ROSIN, sulphur and caustic soda. Bahia, Brazil. Purchase and agency.—12,755.

PAINTS AND VARNISHES. Karachi, India. Agency.—12,745.

COTTONSEED MEAL and corn cakes in sacks. Marseille, France. Agency.—12,750.

EDIBLE OILS. Pleven, Bulgaria. Purchase.—12,787.

Fertilizer Used by Pennsylvania Farmers Shown in Report

The Pennsylvania State Bureau of Foods and Chemistry, Harrisburg, has issued a report covering the sale and distribution of fertilizer for the year recently closing (1923-24), showing that 308,298 tons of fertilizer and 251,836 tons of lime for agricultural use were purchased by farmers in the state during this time. A total of 266 licenses for the sale of commercial fertilizers was issued in this period, representing 1,375 brands and kinds of material. Approximately one-half of these different brands cover high-grade fertilizer, containing 14 per cent or more of plant food. It is pointed out that the sales of low-grade fertilizer, with less than the percentage noted of plant food, show that farmers in the state are still purchasing too much material of this sort.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

Industrial Chemicals

Acetone, drums, works	lb.	$0.14 – $0.15
Acetic anhydride, 85%, dr	lb.	.36 – .38
Acid, acetic, 28%, bbl. 100	lb.	3.12 – 3.37
Acetic, 56%, bbl. 100	lb.	5.85 – 6.10
Acetic, 80%, bbl. 100	lb.	8.19 – 8.44
Glacial, 99½%, bbl. 100	lb.	11.01 – 11.51
Boric, bbl	lb.	.09 – .09½
Citric, kegs	lb.	.45½– .46½
Formic, 85%	lb.	.10½– .10¾
Gallic, tech	lb.	.45½– .47
Hydrofluoric, 52%, carboys	lb.	.11 – .12
Lactic, 44%, tech., light, bbl	lb.	.13½– .14
22% tech., light, bbl	lb.	.06½– .07
Muriatic, 18° tanks 100	lb.	.80 – .85
Muriatic, 20°, tanks 100	lb.	.95 – 1.00
Nitric, 36°, carboys	lb.	.04 – .04½
Nitric, 42°, carboys	lb.	.04¾– .05½
Oleum, 20%, tanks	ton	16.00 – 17.00
Oxalic, crystals, bbl	lb.	.09½– .09¾
Phosphoric, 50% carboys	lb.	.07½– .07¾
Pyrogallic, resublimed	lb.	1.55 – 1.60
Sulphuric, 60°, tanks	ton	8.00 – 9.00
Sulphuric, 60°, drums	ton	12.00 – 13.00
Sulphuric, 66°, tanks	ton	13.00 – 14.00
Sulphuric, 66°, drums	ton	17.00 – 18.00
Tannic, U.S.P., bbl	lb.	.65 – .70
Tannic, tech., bbl	lb.	.45 – .50
Tartaric, imp., powd., bbl.	lb.	.27 – .27½
Tartaric, domestic, bbl.	lb.	.29 – .30
Tungstic, per lb.	lb.	1.20 – 1.25
Alcohol, butyl, drums, wks.	lb.	.27 – .30
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.89 – .....
Denatured, 190 proof No. 1, special bbl	gal.	.61 – .....
No. 1, 190 proof, special, dr.	gal.	.55 – .....
No. 1, 188 proof, bbl	gal.	.65 – .....
No. 1, 188 proof, dr	gal.	.58 – .....
No. 5, 188 proof, bbl	gal.	.60 – .....
No. 5, 188 proof, dr	gal.	.55 – .....
Alum, ammonia, lump, bbl.	lb.	.03½– .04
Potash, lump, bbl	lb.	.02¾– .03½
Chrome, lump, potash, bbl.	lb.	.05½– .06
Aluminum sulphate, com., bags 100	lb.	1.40 – 1.45
Iron free, bags	lb.	2.40 – 2.45
Aqua ammonia, 26°, drums	lb.	.06½– .06¾
Ammonia, anhydrous, cyl.	lb.	.28 – .30
Ammonium carbonate, powd. tech., casks	lb.	.12½– .12¾
Nitrate, tech., casks	lb.	.09 – .10
Amyl acetate tech., drums	gal.	3.50 – 3.75
Antimony oxide, white, bbl.	lb.	.13 – .14
Arsenic, white, powd., bbl	lb.	.06½– .06¾
Red, powd., kegs	lb.	.14¾– .15½
Barium carbonate, bbl	ton	54.00 – 55.00
Chloride, bbl	ton	64.00 – 70.00
Dioxide, 88%, drums	lb.	.17½– .18
Nitrate, casks	...	.07¾– .08¼
Blanc fixe, dry, bbl	lb.	.03½– .03¾
Bleaching powder, f.o.b. wks., drums, contract 100	lb.	1.90 – .....
Spot, wks., drums 100	lb.	2.00 – 2.15
Borax, bbl	lb.	.05 – .05½
Bromine, cases	lb.	.44 – .45
Calcium acetate, bags 100	lb.	3.00 – 3.05
Arsenate, dr	lb.	.08 – .08½
Carbide, drums	lb.	.05 – .05½
Chloride, fused, dr. wks	ton	21.00 – .....
Gran. drums works	ton	27.00 – .....
Phosphate, mono, bbl	lb.	.06½– .07½
Carbon bisulphide, drums	lb.	.06 – .06½
Tetrachloride, drums	lb.	.06¾– .07½
Chalk, precip.—domestic, light, bbl	lb.	.04½– .04¾
Imported, light, bbl	lb.	.04½– .05
Chlorine, liquid, tanks, wks.	lb.	.04¾– .....
Contract, tanks, wks	lb.	.04 – .....
Cylinders, 100 lb., wks	lb.	.05½– .07½
Cobalt, oxide, bbl	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks	ton	15.00 – 16.00
Copper carbonate, bbl	lb.	.17 – .17½
Cyanide, drums	lb.	.49 – .50
Oxide, kegs	lb.	.16½– .16¾
Sulphate, dom., bbl. 100	lb.	4.65 – 4.75
Imp. bbl. 100	lb.	4.50 – .....
Cream of tartar, bbl	lb.	.20½– .21
Epsom salt, dom., bbl. 100	lb.	1.75 – 2.00
Imp., tech., bags 100	lb.	1.35 – 1.40
U.S.P., dom., bbl. 100	lb.	2.10 – 2.35
Ether, U.S.P., dr concent'd	lb.	.15 – .16
Ethyl acetate, 85%, drums	gal.	.92 – .95
Acetate, 99%, dr	gal.	1.08 – 1.10
Formaldehyde, 40%, bbl	lb.	.09 – .09½
Fullers earth—f.o.b. mines	ton	7.50 – 18.00
Furfural, works, bbl	lb.	.23 – .....
Fusel oil, ref., drums	gal.	4.65 – 4.75
Crude, drums	gal.	3.20 – 3.30
Glaubers salt, wks., bags. 100	lb.	1.20 – 1.40
Imp., bags 100	lb.	.80 – .90
Glycerine, c. p., drums extra.	lb.	.19 – .19½
Crude 80%, loose	lb.	.12½– .....
Hexamethylene, drums	lb.	.45 – .67

THESE prices are first-hand quotations in the New York market for industrial chemicals, coal-tar products and related materials used in the industries that produce

Dyes	**Paper and Pulp**
Paint and Varnish	**Petroleum**
Ceramic Materials	**Soap**
Fertilizers	**Explosives**
Rubber	**Food Products**
Sugar	**Metal Products**

Whenever available these prices are those of the American manufacturer. If for material f.o.b. works or on a contract basis, quotations are so designated. All prices refer to large quantities in original packages.

Lead:		
White basic carbonate, dry, casks	lb.	$0.11 – .....
White, basic sulphate, casks	lb.	.10½– .....
White, in oil, kegs	lb.	.1286– .....
Red, dry, casks	lb.	.12½– .....
Red, in oil, kegs	lb.	.1462– .....
Acetate, white crys., bbl	lb.	.15½– .....
Brown, broken, casks	lb.	.14½– .....
Arsenate, white crys., bbl	lb.	.16 – $0.18
Lime-Hydrated, b.g., wks	ton	10.50 – 12.50
Bbl., wks	ton	18.00 – 19.00
Lump, bbl. 280	lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.12½– .....
Lithopone, bags	lb.	.06 – .06½
Magnesium carb., tech., bags	lb.	.07 – .08
Methanol, 95%, drums	gal.	.70 – .72
97%, drums	gal.	.72 – .74
Pure, tanks	gal.	.74 – .76
drums	gal.	.78 – .80
bbl	gal.	.83 – .85
Methyl-acetone, t'ks	gal.	.70 – .....
Nickel salt, double, bbl	lb.	.10 – .....
Single, bbl	lb.	.10½– .....
Orange mineral, csk	lb.	.15½– .16
Phosgene	...	.60 – .75
Phosphorus, red, cases	lb.	.70 – .75
Yellow, cases	lb.	.37½– .40
Potassium bichromate, casks	lb.	.08¼– .08½
Bromide, gran., bbl	lb.	.41 – .47
Carbonate, 80-85%, calcined, casks	lb.	.06 – .06½
Chlorate, powd	lb.	.06½– .08½
Cyanide, drums	lb.	.47 – .52
First sorts, cask	lb.	.08¼– .08½
Hydroxide (caustic potash) drums	lb.	.07½– .07¾
Iodide, cases	lb.	3.65 – 3.75
Nitrate, bbl	lb.	.06 – .07½
Permanganate, drums	lb.	.14 – .15
Prussiate, red, casks	lb.	.36½– .38
Prussiate, yellow, casks	lb.	.16½– .17
Salammoniac, white, gran., casks, imported	lb.	.05½– .06
White, gran., bbl., domestic	lb.	.07 – .07½
Gray, gran., casks	lb.	.08 – .09
Salsoda, bbl. 100	lb.	1.20 – 1.40
Salt cake (bulk) works	ton	16.00 – 18.00
Soda ash, light 58% flat, bulk, contract 100	lb.	1.25 – .....
bags, contract 100	lb.	1.38 – .....
Dense, bulk, contract, basis 58% 100	lb.	1.35 – .....
bags, contract 100	lb.	1.45 – .....
Soda, caustic, 76%, solid, drums contract 100	lb.	3.10 – .....
Caustic, ground and flake, contracts, dr. 100	lb.	3.50 – 3.85
Caustic, solid, 76% f.a.s. N. Y. 100	lb.	2.90 – 3.05
Sodium acetate, works, bbl.	lb.	.05 – .05½
Bicarbonate, bulk 100	lb.	1.75 – .....
Bichromate, casks	lb.	.06¼– .06½
Bisulphate (niter cake)	ton	6.00 – 7.00
Bisulphite, powd., U.S.P., bbl	lb.	.04¼– .04½
Bromide, bbl	lb.	.43 – .47
Chlorate, kegs	lb.	.06½– .06¾
Chloride	long ton	12.00 – 13.00
Cyanide, cases	lb.	.19 – .22
Flouride, bbl	lb.	.08½– .09
Hyposulphite, bbl	lb.	.02½– .02¾
Nitrite, casks	lb.	.09½– .09¾
Peroxide, powd., cases	lb.	.23 – .27
Phosphate, dibasic, bbl	lb.	.03½– .03¾
Prussiate, yel. bbl	lb.	.09½– .09¾
Salicylate, drums	lb.	$0.38 – $0.40
Silicate (40°, drums) 100	lb.	.75 – 1.16
Silicate (60°, drums) 100	lb.	1.75 – 2.00
Sulphide, fused, 60-62%, drums	lb.	.02¾– .03¼
Sulphite, crys., bbl	lb.	.03¼– .03½
Strontium nitrate, powd., bbl	lb.	.09 – .09½
Sulphur chloride, yel drums	lb.	.04½– .05
Crude	ton	18.00 – 20.00
At mine, bulk	ton	16.00 – 18.00
Flour, bag 100	lb.	2.25 – 2.35
Dioxide, liquid, cyl	lb.	.08 – .08½
Tin bichloride, bbl.	lb.	.15½– .....
Oxide, bbl	lb.	.58 – .58½
Crystals, bbl	lb.	.38½– .....
Zinc carbonate, bags	lb.	.12 – .14
Chloride, gran., bags	lb.	.06 – .07½
Cyanide, drums	lb.	.40 – .41
Dust bbl	lb.	.08 – .08½
Oxide, lead free, bags	lb.	.07¾– .....
5% lead sulphate bags	lb.	.06¾– .....
French, red seal, bags	lb.	.09¾– .....
French, green seal, bags	lb.	.10¾– .....
French, white seal, bbl.	lb.	.11¾– .....
Sulphate, bbl. 100	lb.	3.25 – 3.50

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 – $0.62
Alpha-naphthol, ref., bbl	lb.	.75 – .80
Alpha-naphthylamine, bbl.	lb.	.35 – .36
Aniline oil, drums	lb.	.16 – .16½
Aniline salt, bbl	lb.	.22 – .23
Anthracene, 80%, drums	lb.	.65 – .70
Anthraquinone, 25%, drums.	lb.	.65 – .67
Benzaldehyde U.S.P., tech., drums	lb.	.69 – .71
Benzene, pure, tanks, works.	gal.	.25 – .....
Benzene, 90%, tanks, works.	gal.	.23 – .....
Benzidine base, bbl	lb.	.78 – .80
Benzyl chloride, ref. carboys.	lb.	.35 – .....
Benzyl chloride, tech., drums.	lb.	.25 – .....
Beta-naphthol, tech., bbl	lb.	.24 – .25
Beta-naphthylamine, tech	lb.	.65 – .70
Cresylic acid, 97%, drums	gal.	.61 – .63
95-97%, drums, works	gal.	.57 – .59
Dichlorbenzene, drums	lb.	.07 – .08½
Dinitrobenzene, bbl	lb.	.15 – .17½
Dinitrochlorbenzene, bbl	lb.	.20 – .21
Dinitrophenol, bbl	lb.	.35 – .40
Dinitrotoluen, bbl	lb.	.18 – .20
Dip oil, 25%, drums	gal.	.26 – .28
H-acid, bbl	lb.	.70 – .74
Meta-phenylenediamine, bbl.	lb.	.90 – .95
Monochlorbenzene, drums	lb.	.08½– .10
Naphthalene, flake, bbl	lb.	.05 – .05½
Naphthionate of soda, bbl.	lb.	.60 – .65
Naphthionic acid, crude, bbl.	lb.	.60 – .62
Nitrobenzene, drums	lb.	.09 – .09½
Nitro-naphthalene, bbl	lb.	.25 – .27
Nitro-toluene, drums	lb.	.13½– .14
N-W acid, bbl	lb.	1.05 – 1.15
Ortho-amidophenol, kegs	lb.	2.40 – 2.50
Ortho-dichlorbenzene, drums	lb.	.10 – .11
Ortho-toluidine, bbl	lb.	.17 – .18
Para-aminophenol, base, kegs	lb.	1.15 – 1.20
Para-dichlorbenzene, bbl	lb.	.17 – .20
Para-nitraniline, bbl	lb.	.65 – .67
Para-nitrotoluene, bbl	lb.	.40 – .42
Para-phenylendiamine, bbl.	lb.	1.30 – 1.35
Para-toluidine, bbl	lb.	.75 – .80
Phenol, U.S.P., dr	lb.	.24 – .26
Picric acid, bbl	lb.	.20 – .22
Pitch, tanks, works	ton	27.00 – 30.00
Pyridine, imp., drums	gal.	3.75 – 4.00
Resorcinol, tech., kegs	lb.	1.30 – 1.40
Resorcinol, pure, kegs	lb.	2.00 – 2.25
R-salt, bbl	lb.	.50 – .55
Salicylic acid, tech., bbl	lb.	.32 – .33
Salicylic acid, U.S.P., bbl	lb.	.35 – .....
Solvent naphtha, water-white, tanks	gal.	.24 – .25
Crude, tanks	gal.	.21 – .22
Sulphanilic acid, crude, bbl.	lb.	.16 – .18
Tolidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars, works	gal.	.26 – .....
Toluene, drums, works	gal.	.31 – .....
Xylidine, drums	lb.	.40 – .42
Xylene, 5 deg.-tanks	gal.	.36 – .40
Xylene, com., tanks	gal.	.24 – .26

Naval Stores

Rosin B-D, bbl. 280	lb.	$7.60 – $7.65
Rosin E-I, bbl. 280	lb.	7.65 – 7.70
Rosin K-N, bbl. 280	lb.	7.70 – 7.80
Rosin W.G.-W.W., bbl. 280	lb.	8.85 – 9.25
Turpentine, spirits of, bbl	gal.	.85 – .85½
Wood, steam dist., bbl	gal.	.78 – .79
Wood, dest. dist., bbl	gal.	.70 – .74
Pine tar pitch, bbl. 200	lb.	5.50 – .....
Tar, kiln burned, bbl. 500	lb.	12.00 – 12.50
Rosin oil, first run, bbl.	gal.	.45 – .....
Pine tar oil, com'l	gal.	.30 – .....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.05½
Grease, yellow, loose	lb.	.09¼ –	.09¾
Lard oil, Extra No. 1, bbl.	gal.	.96 –	.98
Lard compound, bbl.	lb.	.13¾ –	.14
Neatsfootoil, 20 deg. bbl.	gal.	1.35 –	1.37
Oleo Stearine	...	.12 –	.....
Oleo oil, No. 1, bbl.	lb.	.16 –	.16½
Red oil, distilled, d.p. bbl.	lb.	.11½ –	.11¾
Tallow, extra, loose works	lb.	.10¾ –	.....
Tallow oil, acidless, bbl.	gal.	.92 –	.94

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.17 –	$0.17½
Castor oil, No. 1, bbl.	lb.	.17½ –	.17¾
Chinawood oil, bbl.	lb.	.15¾ –	.16½
Coconut oil, Ceylon, bbl.	lb.	.11¾ –	.12
Ceylon, tanks, N. Y.	lb.	.10½ –	.10¾
Corn oil, crude, bbl.	lb.	.12½ –	.....
Crude, tanks, (f.o.b. mill)	lb.	.10¼ –	.10½
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09¾ –	.10
Summer yellow, bbl.	lb.	.11¾ –	.12
Linseed oil, raw, car lots, bbl.	gal.	1.13 –	1.14
Raw, tank cars (dom.)	gal.	1.07 –	1.08
Boiled, cars, bbl. (dom.)	gal.	1.15 –	1.16
Olive oil, denatured, bbl.	gal.	1.18 –	1.22
Sulphur, (foots) bbl.	lb.	.09 –	.10
Palm, Lagos, casks	lb.	.09¾ –	.....
Niger, casks	lb.	.09 –	.....
Palm kernel, bbl.	lb.	.10½ –	.10¾
Peanut oil, crude, tanks (mill)	lb.	.11½ –	.12
Refined, bbl.	lb.	.16 –	.16½
Perilla, bbl.	lb.	.14½ –	.14¾
Rapeseed oil, refined, bbl.	gal.	.97 –	.98
Sesame, bbl.	lb.	.14¼ –	.14½
Soya bean (Manchurian), bbl	lb.	.13½ –	.....
Tank, f.o.b. Pacific Coast	lb.	.11¼ –	.11½

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.64 –	$0.66
Menhaden, light pressed, bbl.	gal.	.70 –	.72
White bleached, bbl.	gal.	.72 –	.74
Crude, tanks (f.o.b. factory)	gal.	.53½ –	.55
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.90 –	.95
Cochineal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04¾ –	.05
Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags 100	lb.	4.52 –	4.79
Gum, bags 100	lb.	4.82 –	5.09
Divi-divi, bags	ton	42.00 –	43.00
Fustic, sticks	ton	30.00 –	35.00
Chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.20 –	.20½
Logwood, sticks	ton	25.00 –	26.00
Chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	165.00 –	175.00
Domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100	lb.	3.87 –	4.14

Extracts

Archil, conc., bbl.	lb.	$0.16 –	$0.19
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl.	lb.	.05 –	.05
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09½
Gambier, liq., 25% tannin, bbl.	lb.	.13½ –	.14
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, liquid, 51°, bbl.	lb.	.12 –	.13
Logwood, crys., bbl.	lb.	.14 –	.15
Liq., 51°, bbl.	lb.	.07½ –	.08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.04¼ –	.04¾
Sumac, dom., 51°, bbl.	lb.	.06¼ –	.06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.06 –	$0.08
spot, cases	lb.	.10 –	.15
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Prussian, bbl.	lb.	.35 –	.37
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.05 –	.12
Sienna, Domestic, bbl.	lb.	.03 –	.03½
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens-Chrome, C.P.Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.10½ –	.11½
Paris, bulk	lb.	.24 –	.26
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.08 –	.12
Para toner, kegs	lb.	.95 –	1.00
Vermilion, English, bbl.	lb.	1.25 –	1.30
Yellow, Chrome, C.P. bbls.	lb.	.17 –	.17½
Ocher, French, casks	lb.	.02 –	.03

Waxes

Beeswax, crude, Afr. bg.	lb.	$0.33 –	$0.33½
Refined, light, bags	lb.	.36 –	.37
Candellila, bags	lb.	.31 –	.32
Carnauba, No. 1, bags	lb.	.36 –	.37
No. 2, North Country, bags	lb.	.29 –	.29½
No. 3, North Country, bags	lb.	.24 –	.25
Japan, cases	lb.	$0.15½ –	$0.16½
Montan, crude, bags	lb.	.06 –	.06½
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.06 –	.06½
Crude, scale 124-126 m.p. bags	lb.	.05½ –	.05¾
Ref., 118-120 m.p. bags	lb.	.06 –	.06¼
Ref., 123-125 m.p., bags	lb.	.06½ –	.06¾
Stearic acid, sgle. pressed, bags	lb.	.11¾ –	.12¼
Double pressed, bags	lb.	.12½ –	.12¾

Fertilizers

Acid phosphate, 16%, wks.	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works 100	lb.	2.75 –	.....
Blood, dried, bulk	unit	3.85 –	3.95
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags 100	lb.	2.47½ –	2.50
Tankage, high grade, f.o.b. Chicago	unit	3.50 –	.....
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.00 –	3.50
Tennessee, 75%	ton	6.50 –	6.75
Potassium muriate, 80%, bags	ton	34.55 –	.....
Sulphate, bags, 90%	ton	45.85 –	.....
Double manure salt, bgs.	ton	26.35 –	.....
Kainit, 14%, bgs	ton	10.25 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.36½ –	$0.36¾
Upriver coarse	lb.	.28 –	.28½
Plantation—First latex crepe	lb.	.39 –	.39½
Ribbed smoked sheets	lb.	.39 –	.39

Gums

Copal, Congo, amber, bags	lb.	$0.08 –	$0.10
East Indian, bold, bags	lb.	.13 –	.14
Manila, amber, bags	lb.	.14 –	.16
Damar, Batavia, cases	lb.	.28 –	.28½
Singapore, No. 1, cases	lb.	.30 –	.31
Singapore, No. 2, cases	lb.	.21 –	.21½
Kauri, No. 1, cases	lb.	.58 –	.64
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.06 –	.12

Shellac

Shellac, orange fine, bags	lb.	$0.66 –	$0.67
Orange superfine, bags	lb.	.68 –	.69
Bleached, bonedry	lb.	.74 –	.75
T. N., bags	lb.	.63 –	.64

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00 –	$350.00
Shingle, f.o.b., Quebec	sh. ton	45.00 –	50.00
Cement, f.o.b., Quebec	sh. ton	15.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	17.00 –	17.50
Grd., off-color, f.o.b., Balt	net ton	13.00 –	14.00
Floated, f.o.b., St. Louis, bbl.	net ton	23.00 –	24.00
Crude f.o.b. mines, bulk	net ton	8.50 –	9.00
Casein, bbl., tech	lb	.11 –	.12
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	6.50 –	8.00
Powd., f.o.b. Ga.	net ton	12.00 –	16.00
Crude, f.o.b. Va.	net ton	5.50 –	7.00
Ground, f.o.b. Va.	net ton	10.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 –	7.25
No. 2 f.o.b. N.C.	long ton	4.50 –	5.00
No. 1 gr'd. Me.	long ton	19.00 –	20.00
No. 1 Can., f.o.b., mill, powd.	long ton	25.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05½ –	.06
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.12 –	.12½
Tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.15 –	1.20
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N.Y.	ton	50.00 –	55.00
Magnesite, calcined	ton	35.00 –	42.50
Pumice stone, imp., casks	lb.	.03 –	.40
Dom., lump, bbl.	lb.	.06 –	.08
Dom., ground, bbl.	lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.25
Sand blast, f.o.b. Ind.	ton	2.25 –	3.50
Amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Glass sand, f.o.b. Ill.	ton	2.00 –	2.25
Soapstone, coarse, f.o.b., Vt., bags	ton	7.00 –	7.50
Talc. 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 –	.....
200 mesh, f.o.b., Ga.	ton	8.50 –	10.00
325 mesh, f.o.b. New York, grade A	ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 –	$2.85
Corning	bbl.	1.50 –	.....
Cabell	bbl.	1.45 –	.....
Somerset	bbl.	1.55 –	.....
Illinois	bbl.	1.37 –	.....
Indiana	bbl.	1.38 –	.....
Kansas and Okla. under 28 deg.	bbl.	.75 –	.85
California, 35 deg. and up	bbl.	1.40 –	...

Gasoline, Etc.

Motor gasoline steel bbls.	gal.	$0.15 –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal.	.14½ –	.....
Kerosene, ref. tank wagon	gal.	.13 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.34 –	$0.35
Bloomless, 30@31 grav.	gal.	.24 –	.....
Paraffin, pale 885 vis.	gal.	.16½ –	.17
Spindle, 200, pale	gal.	.25 –	.26
Petrolatum, amber, bbls.	lb.	.04 –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40–43
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	33–37
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
9-in. sizes, f.o.b., Birmingham	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	33–35
Silicon carbide refract brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls	ton	$200.00 –	.....
Ferrochromium, per lb. of Cr, 1-2% C	lb.	.30 –	.....
4-6% C	lb.	.10½ –	.11
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	110.00 –	.....
Spiegeleisen, 19-21% Mn.	gr. ton	32.00 –	33.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	1.80 –	2.00
Ferrosilicon, 10-12%	gr. ton	39.50 –	43.50
50%	gr. ton	72.00 –	75.00
Ferrotungsten, 70-80% per lb. of W	lb.	.85 –	.90
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	.....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.25 –	4.00

Ores and Mineral Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	.....
C.i.f. Atlantic seaboard	ton	18.50 –	24.00
Coke, fdry., f.o.b. ovens	ton	4.50 –	4.75
Coke, furnace, f.o.b. ovens	ton	3.50 –	3.65
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 –	18.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½ –	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.39 –	.41
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite 85% MoS_2, per lb. Mo S_2, N. Y.	lb.	.65 –	.75
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 –	.....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	.....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten ore, scheelite, 60% WO_3 and over	unit	9.00 –	9.25
Tungsten, wolframite, white, 60% WO_3	unit	8.85 –	9.00
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 76%	lb.	3.00 –	3.25
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.14½ – $0.14¾
Aluminum, 98 to 99%	lb.	.27 – .28
Antimony, wholesale, Chinese and Japanese	lb.	.15 – .....
Nickel, 99%	lb.	.29 – .33
Monel metal	lb.	.32
Tin, 5-ton lots, Straits	lb.	.57½
Lead, New York, spot	lb.	.0950
Zinc, spot, New York	lb.	.08
Silver (commercial)	oz.	.67½
Cadmium	lb.	.60 – .62
Bismuth (500 lb. lots.)	lb.	1.50–1.55
Cobalt	lb.	2.50–3.00
Magnesium, ingots, 99%	lb.	.90–95
Platinum, refined	oz.	117.00
Mercury 75	lb.	74.00
Tungsten powder	lb.	.95–1.00

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Some Opportunities This Week

Cement	Boyne City, Mich.
Cement	Montreal, Que.
Chlorine	Milwaukee, Wis.
Concentrating Plant	Wellington, N. S.
Dehydration	Harlingen, Tex.
Electric furnace	Toledo, O.
Gas plant	West Virginia
Gas refinery	Fort Collins, Colo.
Gun powder	Stockton, Calif.
Oil refinery	Corpus Christi, Tex.
Oil refinery	Southampton, Ont.
Paper	Madawaska, Me.
Paper	Three Rivers, Que.
Paper	Port Arthur, Ont.
Pulp	Anacortes, Wash.
Rubber	Akron, O.

New England

Me., Biddleford—The City plans the construction of a 3 story, 70 x 100 ft., high school including 6 laboratories. Cost to exceed $300,000. Kronyn & Brown, 220 Devonshire St., Boston, Mass., are architects.

Me., Madawaska — Fraser Companies, Ltd., Edmundston, N. B., plans the construction of a book-paper mill with capacity of 200-ton daily.

South

Ala., Birmingham—Republic Iron & Steel Co., Woodward Bldg., reported as having awarded contract for the construction of a battery of by-product coke ovens at East Thomas, to The Koppers Co., Union Trust Bldg., Pittsburgh, Pa., estimated cost $1,000,000.

Ga., Toomsboro—The Kalbfleisch Corp., 200 5th Ave., New York City, has acquired about 3,000 acres of land containing bauxite deposits in Wilkinson County and plan to develop.

La., New Orleans—Johns-Manville, Inc., Magazine and Gravier Sts., have leased building of the American Cotton Oil Co., Gretna, a structure of 50,000 sq.ft. on a 5 acre site, and will manufacture roofing and shingles, output about 10 cars daily.

West Virginia—Public Service Commission, Munsey Bldg., Baltimore, Md., granted authority to the Southern Gas & Power Corp., W. Whetstone, Pres., for acquisition of 4 natural gas companies in West Virginia and Western Maryland. The company plans the construction of an artificial gas plant in West Virginia, estimated to cost $750,000.

Middle West

Mich., Boyne City—The Boyne City Portland Cement Co., incorporated with $2,000,000 capital stock, plans the construction of buildings and installation of equipment. W. H. White, Pres., L. W. Siegel, Secy.-Treas., and F. B. Grard, Gen. Mgr.

O., Akron—Goodrich Tire & Rubber Co., East Market St., awarded the contract for a 1 story, 60 x 140 ft. addition to factory on South Main St., to Carmichael Construction Co., 524 Central Savings and Trust Bldg., estimated cost $60,000.

O., Sebring—Saxon China Co. awarded the contract for the steel construction for a 1 story, 60 x 180 ft. pottery to Alliance Steel Co., Alliance, kilns to Halcroft Co., 6545 Epworth, Detroit, Mich. Estimated cost $120,000.

O., Toledo—Industrial Steel Castings Co., J. L. Tillman, Pres., is receiving bids for a 1 story, 180 x 150 ft. and 50 ft. high addition to foundry on Millard Ave., estimated cost $200,000. Mills, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., are engineers. An electric furnace to cost $30,000, and other equipment will be installed.

This page is of value not only as a machinery market but also as an index of the general activity and growth of the industries served by Chem. & Met. The reports are gathered by our regular correspondents who are instructed to verify every detail. Requirements for new machinery will be published here free of charge.

Wis., Milwaukee—The Central Bd. of Purchases, D. W. Doan, chm., will receive bids until Jan. 5, for furnishing the Water Department with 40,000 lbs., of chemically pure anyhydrous liquid chlorine in accordance with specifications. J. W. Nicholson, Chief Buyer.

West of Mississippi

Colo., Fort Collins—The American Gasoline & Refining Co., 627 United States National Bank Bldg., Denver, plans the construction of a gas refinery here, estimated cost $200,000.

Tex., Clarksville—The Clarksville Cotton Oil Co. is considering rebuilding a portion of its plant recently destroyed by fire with loss estimated at $35,000 including equipment.

Tex., Corpus Christi—W. K. Campbell, Mid Continent Bldg., Tulsa, Okla., plans the construction of an oil refinery, including machinery here, estimated cost $75,000. Private plans.

Tex., Harlingen — National Dehydration Co., Kansas City, Mo., will soon receive bids for the construction of a 1 story dehydration plant, 600 bu. capacity, estimated cost $35,000. Private plans.

Far West

Calif., Oakland—The Ventura Refining Co. has awarded the contract to H. J. Christenson, 505 Seventeenth St., for a new oil storage and distributing plant, comprising three 1 story buildings, estimated to cost $80,000. R. V. Woods, 505 Seventeenth St., is architect and engineer.

Calif., Stockton — J. E. Morgan, 1015 West Willow St., and J. R. Baker, 632 South Aurora St., plans the construction of a gun powder plant, estimated to cost from $100,000 to $200,000.

Wash., Anacortes — The Fidalgo Pulp Mfg. Co., recently organized, plans the construction of a pulp mill, operating on spruce and hemlock waste from local box factories. O. Anderson, Olympia, and R. S. Talbot, Anacortes, head the concern.

Canada

N. S., Wellington — The Wellington Arsenic Co., will soon start work on the construction of a concentrating plant, estimated cost $10,000.

Ont., Port Arthur—The Nipigon Products Ltd., Nipigon, has purchased the mills of the Western Stevedore Co., 100 miles east of here, on the Canadian National Railway and plans the construction of a large kraft mill in the Thunder Bay district.

Ont., Rapuskasing — The Kimberley-Clarke Co., headquarters at Neenah, Wis., plans the construction of a pulp mill here, to cost approximately $10,000,000. It will have a capacity of 200 tons at the start which will later be increased to 600.

Ont., Southampton — Western Kentucky Coal & Oil Co. plans the construction of a large oil refinery.

Que., Montreal—The National Cement Co. plant at Montreal East, is nearing completion and will start operation about the first of April. Three units will be prepared, each of about 300,000 bbl. capacity per annum.

Que., Three Rivers — St. Lawrence Paper Co., Ltd., plans extensions to paper plant, including installation of 2 new paper machines, estimated cost $3,000,000. H. O. White is engineer.

Incorporations

G. M. Clark Co., Portland, Me., to manufacture and deal in acids, alkalies, oils, salts and mineral compounds. G. M. Clark, Lancaster, N. H., Pres.

National Graphite Corp., Boston, Mass., graphite products, $400,000; D. B. Pattison, Roslindale, F. S. C. Grover, F. J. Bradley, Haverhill.

Symonds, Inc., Boston, Mass., drugs, chemicals, farm products and sundries, $150,000; H. M. Symonds, E. G. Randolph and J. J. McNally, all of Boston, Mass.

Gulfport Creosoting Co., Buffalo, N. Y., $100,000; R. E. Powers, A. E. Fant, F. A. Abbott. (Attorney, Abbott & Abbott, Buffalo.)

Kath Laboratories, Newburgh, N. Y., drugs, $100,000; C. J. Brown, L. C. Tinker, D. C. Truex. (Attorney, H. R. Herman, Newburgh.)

International Feldspar Corp., Oswegatchie, N. Y., St. Lawrence Co., 750 shares preferred stock, $100 each; 2,500 common, no par value; W. Johnson, H. J. E. Kelly, O. W. Loomis. (Attorney, G. . VanKennen, Ogdensburg.)

MacNamara & Weber, New York City, crude rubber, $25,000; W. Wenzel, E. Leask, R. E. MacNamara. (Attorney, A. B. MacNamara, 136 Liberty St.)

Vistor Color Corp., New York City, leather dressings, $100,000; R. C. Shannon, C. L. Vistor, W. Hosken. (Attorney, W. T. VanAlstyne, 128 Broadway.)

Anglo Chilean Consolidated Nitrate Corp., Wilmington, Del., (Corporation Trust Company of America.)

California Zinc Co., Wilmington, Del., $310,000, manufacturing (Corp. Trust Co. of America.)

National Kellastone Co., Wilmington, Del., manufacture magnesite, $300,000. (Corp. Trust of America.)

Adernella Co., Wilmington, Del., manufacture face cream, $100,000. (Corp. Service Co.)

Day Industrial Laboratories, Wilmington, Del., $1,500,000. (F. L. Mettler, Wilmington.)

Nu Grape Co. of America, Wilmington, Del., manufacture and deal in candies, syrups, flavors and extracts, $1,000,000.

Wander Co., Wilmington, Del., chemists, druggists $1,000,000. (Corp. Trust Co. of America.)

Hollywood Perfume Co., Inc., Dover, Del., manufacture and deal in perfumes, $500,000.

Pan-Pharmical Corp., $525,000 manufacture ingredients; H. H. Bram, Norman W. Golsin, S. K. Kraus, Philadelphia. (Delaware Registration Trust Company.)

The Crescent Paint & Mfg. Co., Cleveland, Ohio, $200,000; A. J. Halle, B. S. Brady.

Lisle-Lac Manufacturing Co., 1915 Main St., Kansas City, Mo., manufacture paints, enamels, etc., J. C. Lisle, N. J. Harvey.

American Vinegar Mfg. Co., Oklahoma City, Okla., $100,000; C. H. Russell, 424 West 13th St., J. S. Rose and others.

The Daverin Paper Mills, Ltd., East Camden, Ont., manufacture paper, paper products, etc., $350,000; D. Daverin, E. F. Daverin, St. Catherines, Ont., L. F. Houpt, Buffalo and others.

Vol. 31 *No.* 26

CHEMICAL & METALLURGICAL ENGINEERING

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Contents, December 29, 1924

Appreciation Vs. Depreciation

DEPRECIATION caused by appreation may appear a paradox. Yet the condition of current numbers of *Chem. & Met.* on the reference shelves of the New York Public Library show that it is not a paradox but a fact.

TATTERED and worn to an exhausted condition, the appearance of *Chem. & Met.* is in striking contrast to that of other journals on the same shelves.

THE reason for their condition can be discovered. From early till late they are in continual use. Technical readers generally must appreciate *Chem. & Met.'s* position as an up-to-date, authoritative, interesting journal.

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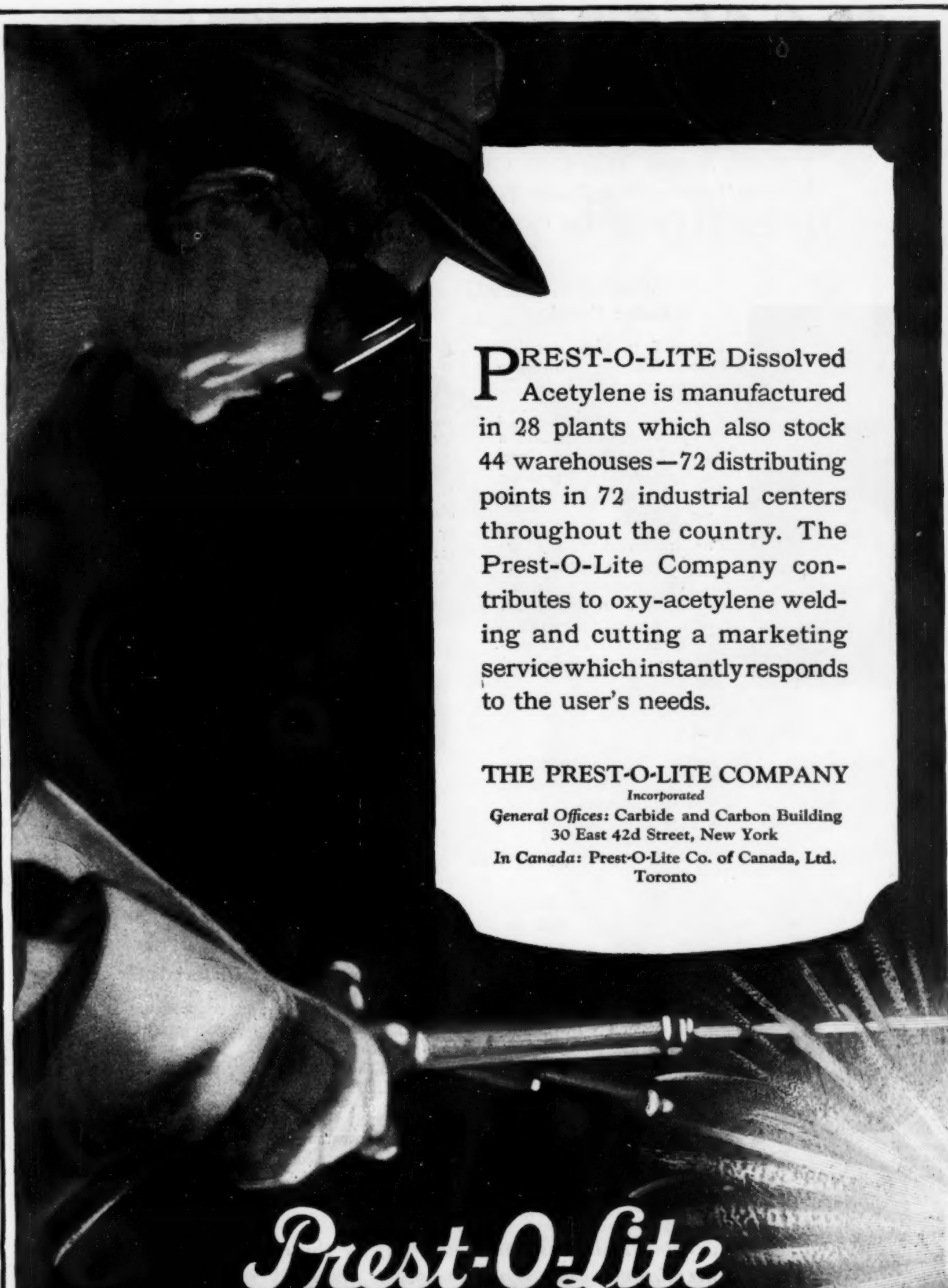
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A complete line of Steam Meters, Boiler Meters, Water Meters, V-Notch Meters, Meters for Granular Materials, Air Meters, Gas Meters, Tachometers, Multi-Pointer Gages, Gravity Recorders and Differential Recorders to meet every requirement in industrial and power plants

Boiler Panel

Designed to give complete information for controlling the operation of a boiler.

The Panel consists of a Bailey Boiler Meter and a Bailey Multi-Pointer Gage, the type of both depending upon the operating conditions at hand.

The important results are recorded on a large chart and the secondary factors are indicated on illuminated scales. The records serve as a complete check on the performance of the individual boilers.

Boiler Meter

Records and integrates Steam Flow, records Air Flow, Flue Gas Temperature and Coal Feed. It removes all doubt concerning the actual relation between the fuel and the air supply within the furnace.

In continuous operation for many years in leading central stations and prominent industrial plants.

Bulletin No. 42 gives complete description with illustration of charts and their proper interpretation. Send for a copy.

Showing oil sealed bell mechanism of Multi-Pointer Gage

Multi-Pointer Gage

This gage has vertical scales and can be equipped with any number up to twelve.

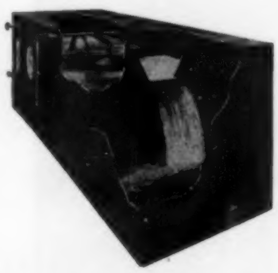
The scales may be graduated to read Draft, Steam Pressure, Temperature, Rate of Flow, Stoker Speed, etc. Also adapted to indicate Turbine Speed and other factors.

Fluid Meter

Records and integrates Steam Flow, either high or low pressure, Feed Water, Service Water and other liquids used in the industries. Records Pressure and Temperature of Steam, Water, etc. on the same chart with the flow.

Indispensable for determining steam distribution and for measuring steam or water sold to tenants or outside consumers.

Weir Meter



Very accurate over a wide range in flow of feed water, turbine condensate, blow-off or any other liquid at or near atmospheric pressure. The operating principle is much simpler and more dependable than other types. Integrates the total flow in pounds, gallons or cubic feet and records the rate of flow on a 12-in. circular chart, upon which the Temperature may be simultaneously recorded.

Meter for Granular Materials

Used for the measurement of coal or other granular material in gravity chutes from overhead bunkers. The total amount is shown on a large illuminated counter dial that can be easily read at a distance of 50 feet.

Rugged in construction and very accurate under proper conditions suitable for installation.

Illustrated Bulletins describing any of the meters mentioned above sent on request. Write

Bailey Meter Company, 2025 E. 46th St., Cleveland, O.

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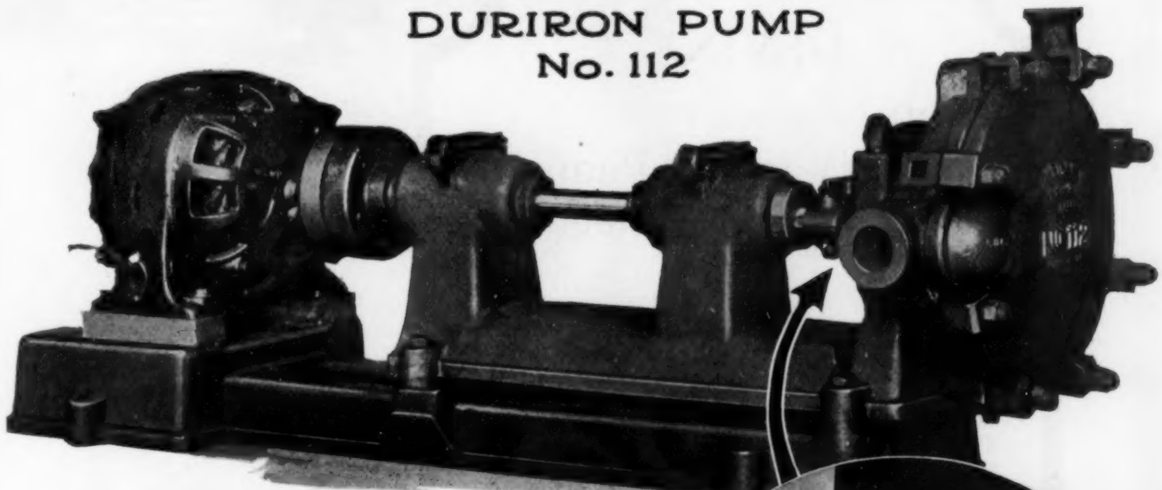
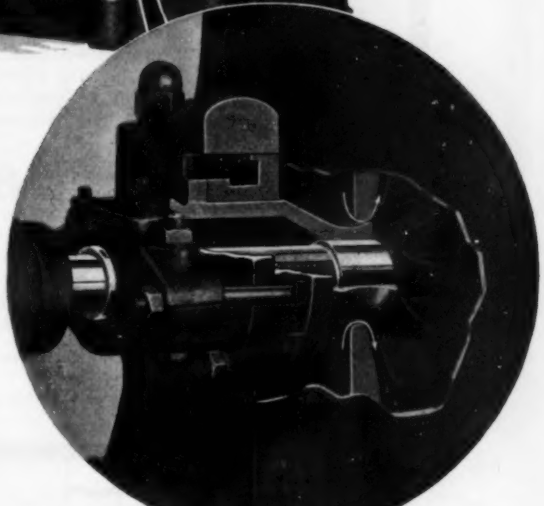
DURIRON ACID PROOF TRADE MARK

Efficient Acid Pumping

DURIRON PUMP
No. 112





This Duriron centrifugal pump (2 in. suction by 1½ in. discharge) has greater efficiency than other pumps of this type, due to the closely machined finish of the various parts.

The impeller and casing have very small clearance and so slippage is negligible. The impeller shroud and stuffing box bearing are likewise so closely finished that "whip" is prevented, together with vibration that reduces the life of packing.

In the insert view showing the stuffing box construction, note the arrows which indicate the direction of flow from suction to impeller side of casing, and that the outside of stuffing box has an *upward curve* which prevents abrupt change in the direction of flow. This causes a jet effect that creates a vacuum on the impeller bearing, so that the stuffing box, being under vacuum, will not leak.

Note also the outer lubricating gland. It is packed with waste or asbestos and oil, and the vacuum created by operation draws in the oil, which forms a seal and permits operation with a relatively loose gland.

Four sizes of impeller, all interchangeable, give approximate heads of 60, 75, 85 and 100 feet.

Let us send Bulletin No. 136, which contains complete information and data on this remarkable pump.

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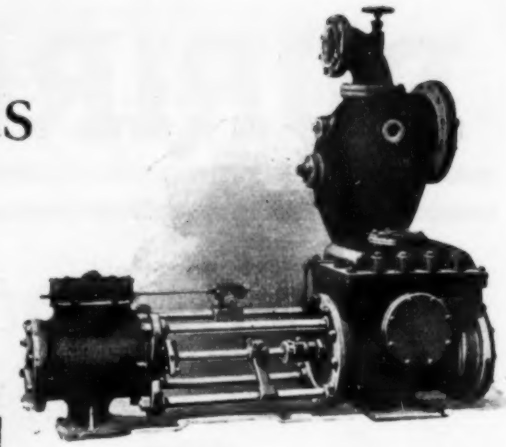
Serving All Types of Evaporating Apparatus



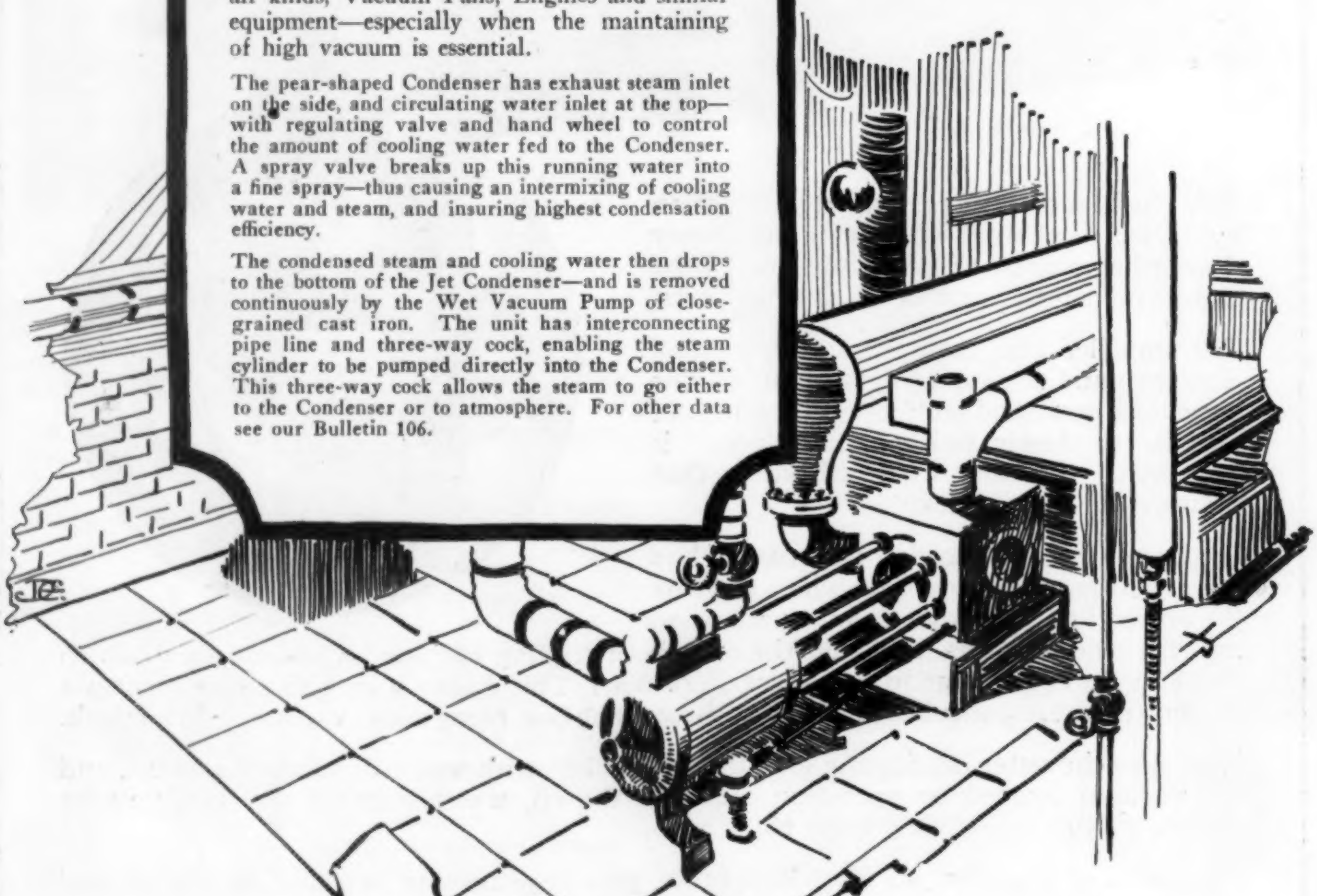
DEVINE

High Efficiency Wet Vacuum Pump and Jet Condenser

—with Condenser mounted over the Pump—is the type of unit we have developed for use in connection with Evaporating apparatus of all kinds, Vacuum Pans, Engines and similar equipment—especially when the maintaining of high vacuum is essential.

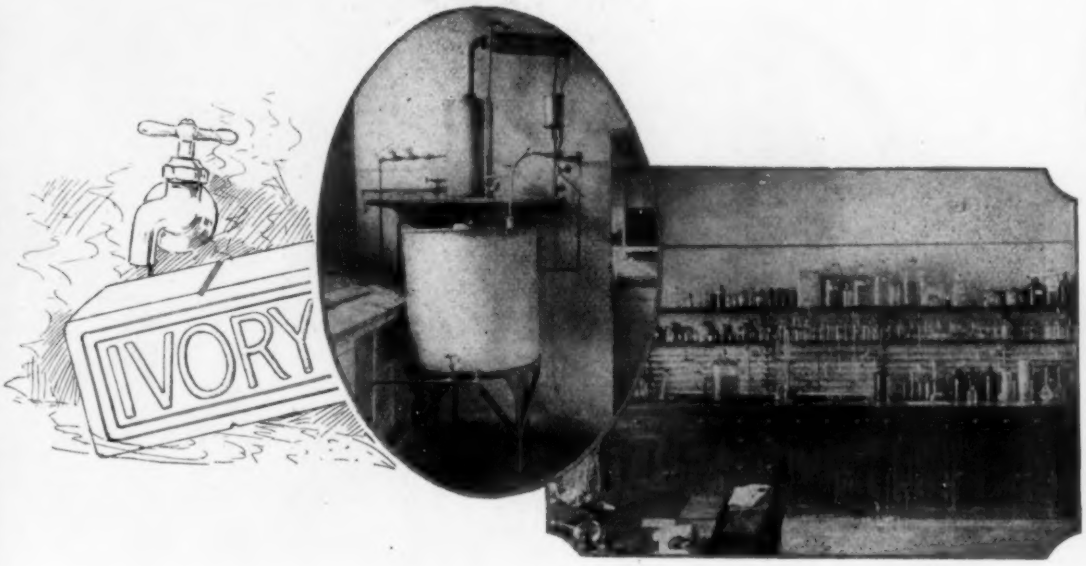
The pear-shaped Condenser has exhaust steam inlet on the side, and circulating water inlet at the top—with regulating valve and hand wheel to control the amount of cooling water fed to the Condenser. A spray valve breaks up this running water into a fine spray—thus causing an intermixing of cooling water and steam, and insuring highest condensation efficiency.

The condensed steam and cooling water then drops to the bottom of the Jet Condenser—and is removed continuously by the Wet Vacuum Pump of close-grained cast iron. The unit has interconnecting pipe line and three-way cock, enabling the steam cylinder to be pumped directly into the Condenser. This three-way cock allows the steam to go either to the Condenser or to atmosphere. For other data see our Bulletin 106.



J. P. DEVINE CO.
1370 Clinton St.
BUFFALO, N. Y.

DEVINE



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Barnstead Stills also are serving Manufacturers of

- Iron and Steel
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This BARNSTEAD installation at the Ivorydale, Ohio, plant of Procter & Gamble Company, is typical of those employed by all the leading makers of soaps and toilet preparations.

The more insistent a manufacturer becomes on refinement of product, the more urgent his need for properly distilled, *chemically-pure* water.

A "Barnstead" produces water of unsurpassed purity—and does it most easily and economically.

The "Barnstead Still Handbook" describes the exclusive features of this standard still. Read of its advantageous use in *your* Processes.

Barnstead Still and Sterilizer Co.
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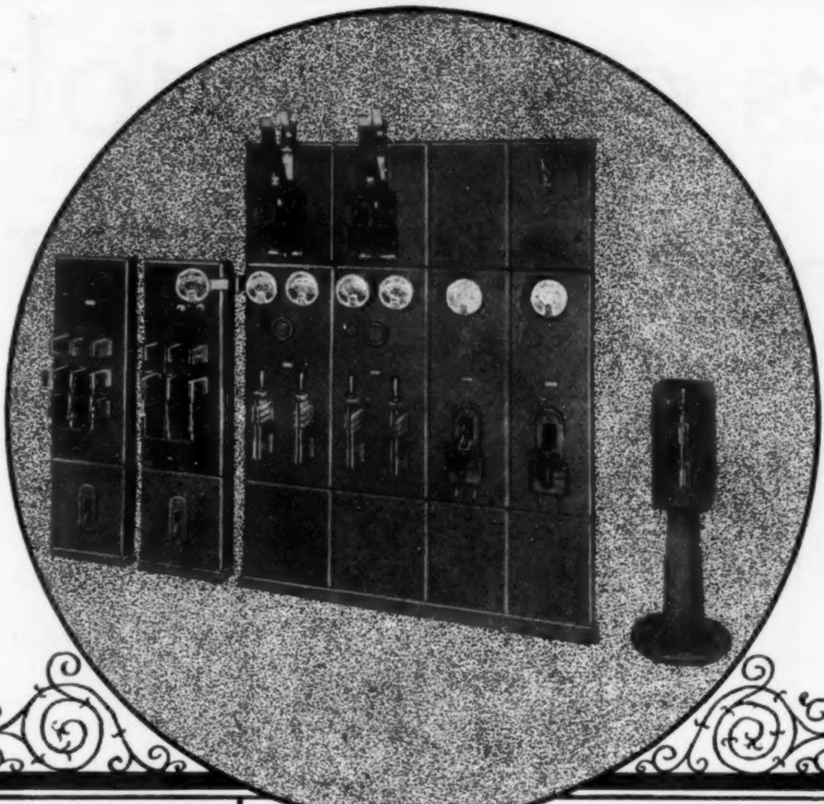
ONLY DISTILLED WATER

BARNSTEAD
WATER STILLS

IS CHEMICALLY PURE



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IN the process industries, little if any attention is paid to the electrical apparatus. It is expected to render faithful service, to operate without interruption, and almost without care.

In building switchboards, Westinghouse pre-supposes the most severe application possible. You can install them—and then forget them. They serve faithfully.

Westinghouse Electric & Manufacturing Co.
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Sales Offices in All Principal Cities of the United States and Foreign Countries

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Westinghouse

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20 years on the job

And even better!

All GOODRICH *and all* GOOD

Air Drill and Tool Hose
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Air Brake Hose
Boiler Washout Hose
Garden Hose
Sprayers' Hose
Oxy-acetylene Hose
Fire Protection Hose *and*
Hose for conducting acids, chemicals, gas, paints, etc.

THIS is an unretouched photograph of a section of Goodrich chemical fire hose, just as we received it from the Taunton, Mass., Fire Department. It is over *twenty years old!*

Made by Goodrich sometime in 1903 or 1904, it is still resilient and full of life after twenty years of active service.

Reports of Goodrich Hose in service for five, ten, fifteen and twenty years are not uncommon. One piece was returned after 27 years' use. While we would not claim that such faithful service is to be expected from every section of Goodrich Hose, yet we do believe that it is proof of the exceptional quality that is built into all hose that leaves the Goodrich factory.

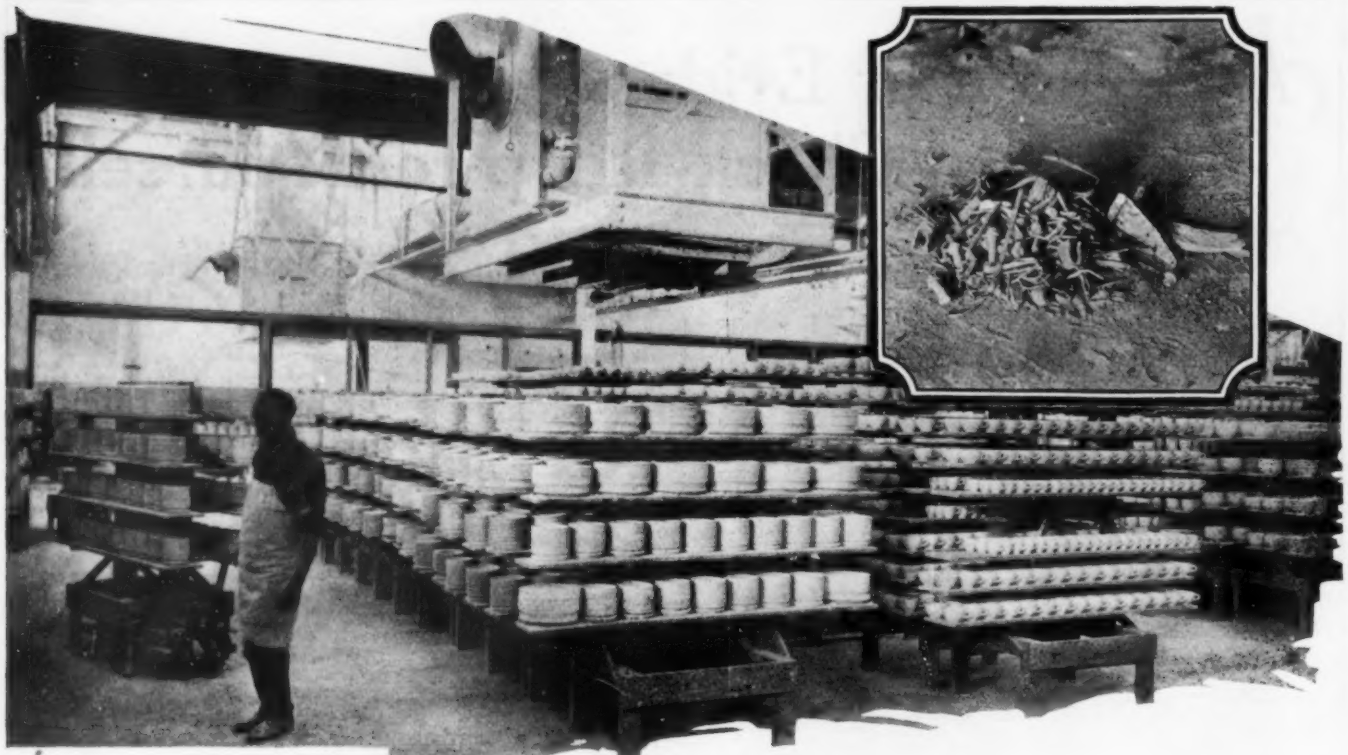
Every brand of Goodrich Hose is built expressly for the job it must handle, and every length may be depended upon for plus service.

Goodrich quality is your economy.

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio *Established 1870*

Goodrich

"Best in the Long Run" **HOSE**



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Full of profit— or full of specks?

THERE is not much profit in iron bespecked china. It can only be sold in bulk and at a loss.

It's just as easy to know whether \$10,000 or \$15,000 worth of pottery is going to turn out successfully as to guess at it.

Little specks of "tramp iron" that ruin valuable pottery can be caught and thrown aside before they can do damage. You can remove it economically from your clay before it takes shape.

A Dings "High Intensity" Magnetic Separator will protect your grinding equipment and your profits. It insures iron-free pottery.

Twenty-five years of magnetic separator manufacture have backed Dings Separators with an unequaled experience. The result is the Dings "High Intensity" Separator of electro-magnet type—a thousand times stronger than a permanent magnet.

Dings brings the strength that reaches out through materials and extracts the finest particles of iron and yet gives low current consumption. Dings brings the rugged structure that means years of service and dependability.

There is only one Dings "High Intensity."

Here is the type of Dings Separator for the ceramic industry. It should not be confused with weak or ordinary horseshoe magnets. The Dings is the only positive method for removing every bit of iron from slip

Dings Magnetic Separator Co.

666 Smith Street, Milwaukee, Wisconsin

Dings High Intensity
MAGNETIC
SEPARATION

C&M 12-298-RTG

In One Simple Operation

NUCHAR

DECOLORIZES DEODORIZES
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It possesses in the highest degree all the properties that are essential in "active" forms of carbon.

1. An inherent purity that prevents contamination of the product treated.
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NUCHAR represents years of experience of the trade requirements and the wide knowledge gained is at the disposal of our customers and prospective users.

We invite correspondence on the application of NUCHAR to your products, and an opportunity to demonstrate its advantages.

Sole Manufacturers

Industrial Chemical Company
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Sodium Tungstate

The Fansteel Company manufactures all grades of Sodium Tungstate. The C. P. grade is especially desirable for those uses where the smallest variation in quality is an important consideration.

The Technical grade comparable to the quality generally sold as C. P. is available where exact control is not so necessary.

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Manufacturers of
Electrical, Steel and Chemical Products
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REFINE with CARBROX

For economy and excellence of operation; sugar, sugar syrups vegetable oils, glycerine, pharmaceuticals, chemicals, etc.

Write us regarding your requirements.

The Barnebey-Cheney Engineering Co.
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PEERLESS
Special Chemical
WHITE LIME

Real 98% lime that will solve your lime problems. It is being shipped regularly to all parts of the U. S.

For the Manufacture of
Calcium Arsenate
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Hunkins-Willis Lime & Cement Co.
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RUBBER ACCELERATORS

The
Roessler & Hasslacher Chemical Co.
709 Sixth Ave., New York

42nd Year

CAUSTIC SODA

(Electrolytic)—76%, 74% and 60% Standard
Bleaching Powder—Liquid Chlorine

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CRUDE SULPHUR

Guaranteed 99½% Pure

For use in Metallurgical field, etc.

THE UNION SULPHUR CO.
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The Best Inert Gas. CO_2. All Uses

Quick Service from Nearby Branches
20 lb. and 50 lb. Drums

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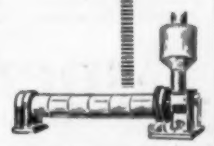

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DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

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HIGH OR LOW TEMPERATURES
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STANDARDIZED OR SPECIALLY DESIGNED EQUIPMENT

Exhaust Systems **Mechanical Draft** **Acid Resisting Fans**
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Positive Volumes of Air or Gas

ROOTS Rotary Blowers and Gas Pumps positively deliver definite volumes of air or gas at lower power cost and practically no upkeep cost. Ask about ROOTS Rotary Pumps and Vacuum Pumps, Gas Meters, Cupola Charging Hoist, Blast Gates, etc.
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Clean the air of dust!
Remove the menace to health caused by grinding and crushing operations, by the

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ELECTRICAL PRECIPITATION
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REFRIGERATING PLANTS

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Ammonia Compression
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Consultation on any Refrigerating Problem Invited

YORK MANUFACTURING CO., York, Pa.

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We design, build and install plants for the recovery of all classes of trade wastes.
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KROMEPATCH
STICKS TO THE BRICK
Reg. U.S. Pat. Off.

A Neutral Refractory Cement That PROLONGS THE SERVICE LIFE of Furnace Linings

E. J. Lavino and Co., Bullitt Bldg., Philadelphia, Pa.

THERMOLITH
FIRE CEMENT
"Makes the Weakest Point the Strongest"
HARBISON-WALKER REFRACTORIES CO.
World's Largest Producers of Refractories
Pittsburgh, Pa. *U.S.A.*

For every process where heat is a factor

Brown Pyrometers
Most used in the world

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AN inorganic chemical laboratory in New England has a position open for a young graduate chemist. State age, training and salary desired. P-175, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMICAL engineer, recent graduate, for Texas oil refinery. Includes drafting, laboratory and plant work. Must have thorough technical foundation and practical ability. Give full details, college activities, experience, photograph. P-176, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

MECHANICAL engineer with chemical plant experience; capable of assuming charge engineering side of chemical plant. A real engineer can make his own job. Others please do not apply. P-161, Chem. & Met. Engrg., 10th Ave. at 36th Sts., New York.

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EXECUTIVES, engineers, will find our individual, confidential service an effective medium in making new connections. Personally conducted by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Our refund agreement protects you. Not employment agency. Jacob Penn, Inc., 305 Broadway, New York.

SALARIED men seeking tentative offers of new connections, are invited to communicate confidentially with the undersigned, who will negotiate overtures without jeopardy to present connections. A professional, ethical service, restricted to high grade positions; established 1910. Retaining fee refunded as provided in our "Refund Contract" if service is not satisfactorily rendered as per contract, and such refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 706 Lockwood Building, Buffalo, New York.

POSITIONS WANTED

CHEMICAL engineer — Ch.E. degree. Graduate of the University of Cincinnati. Six years' varied experience in steel, soap, and leather manufacturing. Desires position in engineering department of large chemical concern. PW-149, Chem. & Met. Engrg., Real Estate Trust Bldg., Philadelphia, Pa.

CHEMICAL patent expert, Ph.D., experienced in patent litigation, wide practical knowledge of industrial chemistry, exceptional bibliographer, reads German, French, Dutch, Spanish, Italian, is open to engagement, whole or part time. Address. PW-178, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

POSITIONS WANTED

CHEMIST, chemical engineering degree, wants position as research or plant chemist. Twelve years of experience in different lines of manufacturing industries. Industrious and resourceful. Chicago district preferred. PW-168, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

CHEMIST, B.A.Sc. Ten years' experience in plant management, chemical and electrometallurgical research, open for engagement in any branch of chemical or metallurgical industry; excellent references. PW-174, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMIST—Experienced in the analysis and duplication of metal cleaners, fluxes and molded insulation, control and analysis of plating solutions, and etching and metal coloring processes. PW-172, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMIST—Eight years' experience in research and manufacture of intermediates and dyestuffs. At present located out of town. Open for moderate offer in any branch of chemistry in the vicinity of New York City. PW-162, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

FACTORY executive, Cornell chemical engineer, with varied experience covering research, the development and commercialization of chemical and allied processes, and plant operation. Particularly familiar with oils, soaps, and nitrocellulose compounds. PW-166, Chem. & Met. Engrg., 10th Ave. at 36th St., N. Y.

GRADUATE chemist and chemical engineer, varied industrial experience in organic and nonferrous metallurgical lines as chemist, chief chemist and superintendent. Capable chief chemist or executive in laboratory or plant. Box 202, Van Buren, Ark.

PATENT assistant, knowledge chemistry, patent low, one time secretary, wants suitable position. PW-108, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

WANT to invest sales personality and energy in live selling proposition. PW-173, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

WANTED
SECOND HAND
LABORATORY MIXERS
for liquids and paste. State size, price, etc.
W-171, Chem. & Met. Engrg.
10th Ave. at 36th St., New York City

WE WANT YOUR
PLATINUM SCRAP
IN ANY FORM
We pay highest market price, make prompt returns and hold goods for your approval.
I. MILLER, Smelter and Refiner
252 Colonial Arcade, Cleveland, Ohio

BUSINESS OPPORTUNITY

Partner With Capital

Manufacturing concern of chemical glassware, importers and exporters, established 1905 with first-class factory buildings, employing a number of the best mechanics in the country, with a world-wide reputation, and serving the leading concerns all over the U. S. A., Canada, as well as the southern Republics, wants a live-wire partner with about $20,000 capital, to increase its output. Answer BO-177, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

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Chemical Periodicals

Numbers 2, 3, 4, 5 and 6, Vol. 28, Year 1923, Chemical and Metallurgical Engineering. Send C.O.D. to Dolomite Products Co., Maple Grove, Ohio.

FOR SALE
Plant in Pittsburgh District
Consisting of building 157x42 ft., boiler house 30x30 ft. Both buildings are of steel and iron construction. Other buildings, of wood construction, are two 32x24 ft. and one 30x20 ft.
600 ft. of railroad siding and 5 acres of real estate.
Plant can be used for chemical manufacture or adapted to foundry work. Will sell with or without equipment.
Keystone Metals Reduction Co.
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FOR SALE
CHEMICAL PLANT
Well equipped, small, either in part, or whole. Address,
BO-71. Chemical and Metallurgical Engrg.
10th Ave. at 36th St., New York City

FOR SALE
Buffalo Reducer, 1600 gals.; Rotary Vacuum Dryer, 3x15; Brunswick 4-ton Refrigerating Machine; Devine Belt-Driven High Vacuum Pumps; Sperry Iron Filter Press, 30x30; Buffalo Aniline Still, 2,500 gal.; Worthington Multitubular Condensers; Devine High Temperature Vacuum Still, complete with receivers, etc., and agitated tanks and kettles, stills, pumps, blow cases, etc.
FS-70 Chemical and Metallurgical Engrg.
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23 HARDINGE CONICAL MILLS
19 CYLINDRICAL PEBBLE MILLS
The size you need is here, turn your grinding trouble over to us. Expert advice and service. Mills to cut, granulate, pulverize, and disperse pigments. Tube, Hammer, Mead, Schutz O'Neill, Raymond mills, crushers, screens. Filter presses, mixers, tanks, any thing for a chemical, paint or milling plant.
EDW. W. LAWLER
Steiner Place, N. Plainfield, N. J.

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2—1 gal. Autoclaves.
6—50 gal. Bronze-Lined Autoclaves.
1—**Atkins-Shriver** 30-in. sq. Filter **Press**, designed for quick emptying.
3—24-in. sq. Wooden Filter Presses.
2—24-in. sq. Cast Iron Filter Presses.
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4—18-in. sq. Wooden Filter Presses.
3—Filter Press **Skeletons.**
6—Jacketed Copper Kettles, capacity from 5 gals. to 100 gals.
1—Ball & Jewell **Rotary Cutter No. 2.**
1—Alsing Rotary Cutter.
2—24-in. Hardinge Conical Ball Mills.
1—36-in. Hardinge Conical Ball Mill.
1—Abbe Ball Mill, 52 in. dia. x 42 in.
3—Ball Mills, 24x48 in.
2—300 gal. **Dopp Mixing Kettles.**
2—150 gal. W. & P. Jacketed **Mixers.**
1— 40 gal. Ross Mixer.
1— 3 gal. Ross Mixer.
1— 1 gal. W. & P. Mixer.
2—Farrell Foundry Crushers, 6x10 in.
2—Jeffrey Hammermill Crushers.
1—Braun Laboratory Crusher.
1—350 gal. **Dur-Iron Jacketed Still.**
1—150 gal. Jacketed Copper Still.
9—**Aluminum Stills,** 80-115 gals.
1—100 gal. Jacketed Mixing Still.
6— 70 gal. Cast Iron Stills.
2— 60 gal. Jacketed **Copper Stills.**
70—**Aluminum Kettles,** jacketed; capacity 40, 60, 80 and 100 gals.
25—Jacketed Dopp Kettles; 60-75 gals.
1— 150 gal. **Subliming Still.**
5—1600 gal. Sulphonator-Nitrators.
6—1600 gal. Reduction Kettles.
2— 500 gal. Jacketed Sulphonators.
3— 400 gal. Fusion Kettles.
12—**Ore Concentrators,** 2 ft. wide x 4 ft. high x 5 ft. long; practically new.
50—Storage Tanks, 200 to 8000 gals.

Machinery & Equipment Co., Inc.
225 Sherman Ave., Newark, N. J.
Phones 7707-7708 Waverly

W. & P. Mixer Parts

New spare parts for Werner & Pfleiderer Size 15, Type BB Mixing Machines. Gears, clutches, shifters, pulleys, guards, sprockets, cover frames, sigma blades, clutch parts, etc.

All Unused Stock and Priced Exceptionally Low.

Nashville Industrial Corporation
Old Hickory, Tennessee

ACID COOLERS

Two carloads 6-in. Cast Iron Pipe, 10-ft. lengths, flanged both ends, for sulphuric acid coolers. Weight 55 lbs. per foot. Offered at a bargain.
One carload 16-in. Cast Iron 90° Ells, new, never used, for gas lines.
Also 24-in. Ells and Tees and Flanged Pipe for SO_2 Coolers, base ells, side outlet tees, base ells and other heavy fittings in 14, 16 and 24 in.

Nashville Industrial Corporation
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Loaned, bought and sold after thorough overhauling. Special parts of any description—leaves, bags, gaskets at lowest prices.

EMIL E. LUNGWITZ
90 West Street, New York

HART CONDENSERS

3000—3-in. Glass condenser tubes, new. Duriron and chemical ware manifolds for Hart Condensers.
Now offered at a bargain

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee

CHEMICAL EQUIPMENT

MIXERS

2—No. 40 Day Imperial Mixers. Large, heavy duty machines used for mixing heavy, stiff material.

DRYERS

1—Buffalo J-20 Shelf Dryer. Twenty shelves, 60x80 in. spaced 2½ in. apart with condenser. Very good condition.

STILLS

2—Iron stills consisting of tank 6 ft. dia. x 5 ft. high made of ⅝-in. plate containing 300 ft. of 2-in. pipe. One new and one slightly used.

1—Iron fractionating still, thirteen sections each 1 ft. 8 in. high x 36 in. dia. Total height 20 ft. Used but in good condition.

KETTLES

4—2,000 gal. heavy steam jacketed kettles. Size 6 ft. dia. x 8 ft. 8 in. long. With agitator. Steam jacket tested at 400 lbs. Only slightly used.

1—500 gal. cast iron, half jacketed, Style B, Dopp Kettle with agitator.

May we send you a complete list of our SURPLUS CHEMICAL EQUIPMENT? We will do so, gladly.

By-Products Sales Division

THE GOODYEAR TIRE & RUBBER COMPANY
Akron, Ohio

BOILERS

2—500 hp. Keeler boilers with self supporting stacks, Wetzel Stokers, and all accessories. 160 lbs. pressure.
12—823 hp. B. & W. Stirling Water Tube Boilers, Class M-30 200 lbs. pressure. Westinghouse stokers, forced draft fans. Vulcan soot blowers and all accessories.
2—300 hp. Heine boilers, 150 lbs. pressure. Murphy stokers and accessories.

Write for prices and specifications.

Nashville Industrial Corporation
Old Hickory, Tennessee

FOR SALE

4—Wooden and Iron **Filter Presses;** 3—Pressure **Steel Kettles; Stoneware Pots; Vacuum Filters; Tourills;** 2—Small **Compressors;** 1—**Elyria Evaporator;** 1—**Steam Engine;** 15—Steel and 30—Wooden **Tanks.** Also other small equipment.

KEYSTONE METALS REDUCTION CO.
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CONTACT ACID UNITS

Five complete contact sulphuric acid units, each 70 tons capacity in two lines of 35 tons each.
Write for particulars.

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee.

OFFERED FROM STOCK

DRYERS

12—Vacuum Shelf Dryers, 27, 23 and 11.
2—Bronze Vac. Drum Dryers, Devine, 40-30 in.
1—4x30 ft. American Process Rotary Dryer.
1—4x20 ft. Rotary Vacuum Dryer.
2—5x33 ft. Rotary Vacuum Dryers.
1—4x8 ft. Atmospheric Drum Dryer.
1—4x10 ft. Atmospheric Double Drum Dryer.
6—Gordon Shelf and Truck Type Dryers.

DISTILLING APPARATUS

1—60 in. copper column unit.
15—Copper and C. I. columns from 10 in. to 60 in complete.
5—Copper Vacuum stills, 30, 75, 300 gals.
6—Aluminum stills, 100 gals.

REFRIGERATING PLANTS

6—Brunswick & York—2, 4, 6, 8 and 10 ton.

FILTER PRESSES

9—Sweetland Nos. 12, 10, 9, 7, 5 and 1.
9—Kelleys Nos. 850, 450, 250 and 150.
1—Oliver 6x4x6x6.
1—Industrial 6x5 ft.
30—Filter Presses, wood and iron, all types complete, from 12 to 42 in.

CENTRIFUGALS

2—48-in. Schaum & Uhlinger copper basket.
2—42-in. Schaum & Uhlinger, motor driven.
4—40-in. Tolhurst.
2—36-in. Steel baskets.
3—36-in. copper baskets.
5—26-in. copper baskets.
1—28-in. copper basket.
2—36-in. Bronze baskets.
17—Copper and steel, over driven and underdriven Extractors, complete from 12 to 60 in.

KETTLES JACKETED

40—80-gal. aluminum.
120—Jacketed kettles, iron copper, steel from 25 to 1,200 gals.
2—50-gal. jacketed and agitated.
6—400-gal. jacketed and agitated.
2—500-gal. jacketed and agitated.
2—600-gal. jacketed and agitated.
1—800-gal. cast iron kettles.
1—1,000-gal. Nitrator.
15—Nitrators and Sulphonators, complete from 2 to 1,500 gals.

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Raymond Mills, Nos. 0000—000—00.
1—20-in. Schutz O'Neil Mill.
6—Mead Mills, No. 1 and No. 3.
Pebble Mills.

WERNER AND PFLEIDERER MIXERS

7—Size XV, 100-gal.
2—Size XVII, 200-gal.
1—100-gal. Vacuum Mixer.
1—50-gal. jacketed heatable blades.

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2—Brand new, 12 in. General Ceramic stoneware Blowers.
3—Glens Falls Sulphur Burners 4x16-ft.
25 Tons of Assorted Duriron, new.

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Phone—Barclay 0603. Wire—Phone—Write.
Cable address Equipment
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The largest stock of spares and repair parts in the country for American Machine & Tool Company's 42-in. Centrifugal Wringers. Wringer heads, quills, bearings, shafting, couplings, spindles, baskets, curbs, casings, fume outlets, duriron conical bottoms, etc. *Priced Exceptionally Low.*
All New Stock, Never Used or Installed.

Nashville Industrial Corporation
Old Hickory, Tennessee

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Duriron Co.

Acid Eggs
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Acid Plants, Hydrochloric, Nitric & Sulphuric
Chemical Construction Co.

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Harbison-Walker Refractories Co.
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Sifters, Gyratory & Vibrating
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Resisto Pipe & Valve Co.
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Knight, Maurice A.

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Bailey Meter Co.
Bristol Co.
Brown Instrument Co.
Republic Flow Meters Co.
Taylor Instrument Co.

Tile or Blocks, Acid Proof
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Towers, Acid and Wood
National Tank & Pipe Co.

Towers, Acid, Metal
Duriron Co.

Towers, Condensing or Absorption, Acid Proof
Knight, Maurice A.

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Knight, Maurice A.

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Standard Alloys Co.

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Valves, Balance, Lever, Float, Reducing Pressure, Back Pressure, etc.
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Valves & Fittings, Acid Proof Lined with Lead
Resisto Pipe & Valve Co.

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Duriron Co.

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Welding Materials
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Cleveland Wire Cloth Mfg. Co.
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Designed and built by men who know centrifugals because TOLHURST builds nothing but centrifugals. *Specialization* reflects in the TOLHURST Center-Slung Centrifugal the intimate knowledge of the user's requirements and the solution to your needs.

TOLHURST Center-Slung is built with or without bottom discharge—with direct connected motor, countershaft or individual motor drive. Baskets and cases are made to meet any chemical requirement and the TOLHURST Center-Slung can be hermetically sealed. Sizes: 40 inch, 48 inch and 60 inch.

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San Francisco Representative
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San Francisco, Cal.

TOLHURST
REG. U.S. PAT. OFF.
CENTRIFUGAL
EXTRACTORS

© TOLHURST MACHINE WORKS ESTABLISHED 1852. TROY. N.Y.

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